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GEOPHYSICS, ASTRONOMY AND SPACE

No. 397

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GEOPHYSICS, ASTRONOMY AND SPACE

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CONTENTS PAGE

I. ASTRONOMY

News

NEW VOLUME OF LUNAR ATLAS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 11, 1976 11.51.37K

[Abstract of monograph; Moscow, ATLAS OBRATNOY STORONY LUNY. CH. 3 (Atlas of the Far Side of the Moon. Part 3), "Nauka," 1975, 239 pages]

[Text] Contents: I. Photographic Experiments on the Zond-6, 7, 8 Spacecraft; II. Selenocentric Coordinate System in the Eastern Sector of the Far Side of the Moon; III. Unified System of Selenodetic Coordinates of 2,900 Points on the Visible Hemisphere of the Moon; IV. Selenodetic Horizontal Base on the Far Hemisphere of the Moon; V. Cartometric Investigations of the Visible and Far Hemispheres of the Moon; VI. Photometric Maps of the Eastern Sector of the Far Side of the Moon. Appendices: 1. Information on Workers in Science and Technology Whose Names Have Been Applied to Craters on the Far Side of the Moon; 2. Photographs of the Lunar Surface from the Zond-8 Spacecraft.
[17]

ARTICLES ON PLANETOLOGY

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 11, 1976 11.51.35

[Abstract of collection of reports; Moscow, TEKTONIKA I STRUKTURNAYA GEOLOGIYA. PLANETOLOGIYA (Tectonics and Structural Geology. Planetology), MEZHDUNAR. GEOL. KONGR. XXV SESSIYA. DOKL. SOV. GEOLOGOV (International Geological Congress 25th Session. Reports of Soviet Geologists), "Nauka," 1976, 318 pages]

[Text] The section on "Planetology" contains the following articles: A. A. Yaroshevskiy -- "Principle of Planetary Differentiation and the Composition of Lunar Rocks"; L. S. Tarasov -- "Principal Petrochemical Characteristics of Mare and Continental Rocks on the Moon"; K. P. Florenskiy, A. T. Bazilevskiy, N. N. Grebennik, R. O. Kuz'min, V. P. Polosukhin, V. D. Popovich and A. A. Pronin -- "Processes in Transformation of the Lunar Surface in the Lemonnier Region on the Basis of the Results of a Detailed Study on the 'Lunokhod-2'"; B. A. Okulesskiy -- "On the Origin of Lunar Magnetism"; O. L. Kuskov and N. I. Khitarov -- "Physicochemical Basis of the Possible Composition of the Cores of the Earth and Venus"; V. V. Kozlov, Yu. Ya. Kuznetsov and Ye. D. Sulidi-Kondrat'yev -- "Principal Characteristics of Tectonics of Planets of the Earth Group"; K. P. Florenskiy, A. T. Bazilevskiy, R. O. Kuz'min, V. D. Popovich and A. A. Pronin -- "Geological Structure of the Erythrean Sea on Mars"; A. L. Sukhanov -- "Peculiarities of the Geological Structure of the Portion of Mars Surveyed by the 'Mars' Automatic Stations". [17]

Abstracts of Scientific Articles

SPACE PROBLEMS IN DEVELOPMENT OF HUMAN SOCIETY

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.51.16

[Abstract of article by A. V. Zasov, A. S. Zelentsov, G. A. Kuznetsov, U. A. Radzhabov and N. I. Shakura; Moscow, NAUCH. DOKL. VYSSH. SHKOLY FILOS. N., No 3, 1976, pp 161-164, "Space Problems in the Development of Human Society"]

[Text] This is a brief report on a conference held at Moscow State University with the participation of scientists from the Space Research Institute USSR Academy of Sciences and other scientific institutes in Moscow. It was attended by astrophysicists, biologists, philosophers, engineers and also USSR flier-cosmonauts. The following matters were discussed: how the universe was formed and how it evolved; whether the universe has other worlds populated by rational beings; what are the future prospects for the mastery of space.
[17]

AUTOMATION OF SOLAR TELESCOPE CONTROL

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.54.84

[Abstract of article by Mir Klvana; Prague, JEMNA MECH. A OPT., 21, No 5, 1976, pp 146-148, "Automation of Control of a Ground Solar Telescope"]

[Text] The article describes a system for telescope control which makes use of stepped motors. The system consists of an automatic device for eliminating the errors in position of the image of the solar disk on the entrance slit of a spectrograph, an automatic scanning device for moving the solar image on the slit by means of a photoelectric sensor and a device for processing magnetograph signals. The system makes possible a precise determination of the position of the observed region.
[17]

RADIOEMISSION OF SOLAR FILAMENTS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.51.399

[Abstract of article by G. P. Apushkinskiy, A. N. Tsyganov and N. A. Topchilo; Moscow, SOLNECHNYYE DANNYYE, No 2, 1976, pp 56-62, "Methods for Investigating and Processing the Radioemission of Solar Filaments"]

[Text] This is a discussion of the possibilities of using observations of the radioemission of filaments at different wavelengths in the millimeter range for ascertaining the physical characteristics in filaments. Also given are the brightness temperatures and dimensions for 71 radiofilaments obtained by a method which takes into account smoothing by the antenna directional diagram. On the basis of these data it was possible to obtain a statistical model of temperature distribution along the height of the radiofilament. Bibliography of nine items.
[17]

HELIOLATITUDE EFFECT IN RECEPTION OF RADIOEMISSION

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.51.382

[Abstract of article by L. I. Yurovskaya; --, TSIRKULYAR SHEMAKHIN. ASTROFIZ. OBSERV., No 48-49, Feb-Mar 1976, pp 8-9, "Heliolatitude Effect in the Reception of Meter-Wavelength Radioemission at the Earth"]

[Text] This is a brief communication. On the basis of an investigation of the integral fluxes of solar radioemission at frequencies of 100-260 MHz in periods of the solar activity maximum 1956-1959 and 1967-1970 it was possible to find the heliolatitude dependence in the reception at the earth of meter radioemission. This dependence is attributed to the existence near the solar equator of a thin layer of plasma extending to 1 a.u. or more and weakening by several times the intensity of radioemission. The degree of weakening increases in the direction of the low frequencies. The position of the layer is dependent on the relationship between the activity of the northern and southern solar hemispheres.
[17]

LONG-PERIOD RHYTHM IN SOLAR RADIOEMISSION

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.51.415

[Abstract of article by V. I. Kuksenko and V. N. Mikhaylovskiy; --, TSIRKULYAR SHEMAKHIN. ASTROFIZ. OBSERV., No 48-49, Feb-Mar 1976, pp 11-12, "Tidal Long-Period Rhythm in Solar Radio Emission"]

[Text] This is a brief communication. It presents new data on the gravitational effect of the planets on the sun: 1) a synchronous change in the radioemission flux at a wavelength of 3 cm and the integral characteristic of the rotor Ω of the momentum of planetary tide-generating forces on the solar surface; 2) a change in the integral characteristic Ω with latitude with a maximum at latitudes 10-30°; 3) a coincidence of the latitudinal change in the intensity of the λ5303 line and spot area with the integral characteristics Ω in the course of the 11-year solar activity cycle.
[17]

NOISE STORMS AND SUNSPOT MAGNETIC FIELD STRENGTH

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.51.420

[Abstract of article by G. F. Yeliseyev, L. F. Lazareva and V. F. Chistyakov; --, TSIRKULYAR SHEMAKHIN. ASTROFIZ. OBSERV., No 48-49, Feb-Mar 1976, pp 12-13, "Correlation Between Fluctuations of the Background of Noise Storms and Strength of the Magnetic Fields of Sunspots"]

[Text] These are summaries of reports. The authors compare simultaneous observations of the radioemission of 34 noise storms at a frequency of 208 MHz and the magnetic fields of sunspots in accordance with the line Fe I λ 6302.5. It was found that in 70% of the cases there is a correlation between variations of the radioemission flux and variations of magnetic fields. With an increase in fluctuations in noise storms there is an increase in the amplitude of magnetic field fluctuations. It is also pointed out that the variations of magnetic fields outstrip the fluctuations in noise storms by an average of 14 minutes.
[17]

SATELLITE OBSERVATIONS OF FLUCTUATIONS OF KILOMETER-RANGE RADIOEMISSION

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.51.361

[Abstract of article by V. P. Grigor'yeva, G. I. Pugacheva and I. P. Shestopalov; --, TSIRKULYAR SHEMAKHIN. ASTROFIZ. OBSERV., No 48-49, Feb-Mar 1976, pp 16-17, "Quasiperiodic Fluctuations of Radioemission in the Kilometer Range Aboard the 'Prognoz-1' Artificial Earth Satellite"]

[Text] This is a brief communication. A Fourier analysis of fluctuations of the amplitude of radioemission at frequencies 200, 350 and 700 KHz according to observations aboard the "Prognoz-1" artificial earth satellite during a quiet period of solar activity indicated the presence of

quasiperiodic components with periods of 3,500±300 sec and possibly 28.5± 2 minutes. The same variations were detected in fluctuations of the flux of electrons with an energy of 40 keV. It is postulated that there is a correlation between these periods and fluctuations of the sun as a whole.
[17]

BEAM DESIGN FOR ASTRONOMICAL TELESCOPES

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.51.82P

[Abstract of patent by Helmut Bohme; Berlin, GDR Patent No 114465 (No 182356), published 5 August 1975, "Gitterkorper fur Astronomische Fernrohre"]

[Text] The invented object is a beam construction of a telescope tube consisting of a middle part and two outer parts. The outer parts are connected to the middle part by means of shafts. At the points of attachment the shafts are connected in twos and the points of connection on one part are situated in the middle of the angle of connection on the other part. The middle part of the telescope in cross section has the configuration of a polygon with an odd number of angles. In contrast to similar designs, this beam construction ensures a greater rigidity and accuracy with lesser construction and material expenditures.
[17]

SPECTRAL OBSERVATIONS OF SOLAR RADIOEMISSION

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.51.83

[Abstract of article by O. S. Korolev, A. K. Markeyev and G. P. Chernov; --, TSIRKULYAR SHEMAKHIN. ASTROFIZ. OBSERV., No 48-49, Feb-Mar 1976, pp 17-18, "Spectral Observations of Solar Radioemission at IZMIRAN [Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation]"]

[Text] This is a brief communication on the parameters of three IZMIRAN spectrographs operating in the range 93-230 MHz. All the spectrographs have superheterodyne circuits with a superhigh frequency at the input and continuous frequency tuning on the principle of magnetic variometers. In the range 45-90 MHz the frequency is tuned 10 times per second and the frequency resolution is 0.5 MHz. At frequencies 93-230 MHz the tuning rate is 50 Hz and the resolution is 0.1 MHz. Simultaneous observations with the three spectrographs make it possible to analyze the different fine structure in the dynamic spectra of different bursts.
[17]

PHYSICAL CHARACTERISTICS OF GALILEAN SATELLITES OF JUPITER

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 11, 1976 11.51.272]

[Abstract of article by V. V. Avramchuk and T. P. Semenyuk; --, ASTROMETRIYA I ASTROFIZIKA. RESP. MEZHVED. SB., No 30, 1976, pp 32-46, 91, "Physical Characteristics of the Galilean Satellites of Jupiter. I (Review and Analysis of Results"]

[Text] The authors examine the results of study of variations in the brightness and color of Galilean satellites in dependence on the solar phase angle and orbital position relative to Jupiter. Also discussed in detail are the results of measurements in different parts of the spectrum of the geometric albedo of the satellites. In addition, observations of satellites are analyzed from the point of view of the detection in their spectra of absorption lines or bands different from the Fraunhofer or telluric lines. Bibliography of 41 items.
[17]

TECTONICS OF THE EARTH AND MOON

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 11, 1976 11.51.279DEP

[Abstract of unpublished article by O. A. Kulibekov; Alma-Ata, NEKOTORYYE REZUL'TATY ISSLEDOVANIYA TEKTONIKI ZEMLI I LUNY (Some Results of Investigations of Tectonics of the Earth and Moon), Astrophysical Institute Academy of Sciences Kazakh SSR, 1976, 13 pages [Manuscript deposited at the All-Union Institute of Scientific and Technical Information, 27 May 1976, No 1883-76DEP]]

[Text] A comparison of the secular variation of relative sunspot number with variations of tectonic activity of the earth and moon indicates the existence of a secular variation of the earth's seismicity and temporal phenomena on the visible hemisphere of the moon. Investigation of the dependence of seismicity in different regions ($M \geqslant 5.0$; $h \leqslant 70$; $70 \leqslant h \leqslant 300$; $h \geqslant 300$ km) on the position of the moon in orbit gives an indication of the existence of a periodicity of these processes. Preliminary data on the investigation of n_i (true distribution) do not permit assumption of a random distribution of seismicity for the investigated regions.
[17]

IR RADIATION OF VENUSIAN CLOUDS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 12, 1976 12.51.247

[Abstract of preprint by L. V. Ksanfomaliti, Ye. V. Dedova, L. F. Obukhova, N. V. Temnaya and G. F. Filippov; Moscow, INFRAKRASNOYE IZLUCHENIYE OBLAKOV VENERY (IR Radiation of Venusian Clouds), Space Research Institute USSR Academy of Sciences, Preprint Pr-289, 1976, 24 pages]

[Text] The thermal IR radiation of Venus, measured by the "Venera-9" and "Venera-10," exhibits a considerable asymmetry in the day-night direction. The radiation of the nighttime side corresponds to a brightness temperature of 244°K. The brightness temperature of the daytime side is 233-234°K. The extent of the upper layer of clouds in which thermal radiation is formed is 4-6 km. The altitude of the radiating layer above the planetary surface (64-67 km) was determined from the brightness temperature and existing models of the Venusian atmosphere. In some cases there is a correlation between inhomogeneities and details of the UV image. The daytime temperatures strangely coincide with the freezing point of sulfuric acid with a concentration of 66-77%.
[23]

CORRELATION OF SOLAR-GEOMAGNETIC-ATMOSPHERIC PROCESSES

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 12, 1976 12.51.434

[Abstract of article by O. V. Kaydalov and Yu. I. Portnyagin; Moscow, TR. IN-TA EKSPERIM. METEOROL. GUGMS, No 5(62), 1976, pp 50-55, "On the Problem of the Correlation of Parameters of Solar and Geomagnetic Activity and Dynamic Processes at Altitudes 80-100 km"]

[Text] The paper gives data from regular measurements of wind velocities at altitudes 80-100 km obtained by the radar observation of meteor trails. The results of these measurements constitute physically homogeneous experimental material suitable for investigation of the important problem of solar-atmospheric relationships. The article gives the mean values of different wind components evaluated on the basis of measurement data separately for the winter and summer seasons. Bibliography of seven items.
[23]

METHOD FOR OBTAINING DATA ON FLUCTUATIONS OF SOLAR RADIOEMISSION

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 11, 1976 11.51.381

[Abstract of article by Ye. A. Aver'yanikhina and M. M. Kobrin; --, TSIRKULYAR SHEMAKHIN. ASTROFIZ. OBSERV., No 48-49, Feb-Mar 1976, p 8, "On Some Possibilities for Obtaining Information on Fluctuations of Solar Radioemission from an Analysis of the Probability Densities of Their Envelopes"]

[Text] This is a brief communication. It is shown that on the basis of the value of the normalized third-order central moment of the probability density of the signal envelope it is possible to judge whether the investigated process is related to an additive mixture of normal noise and a harmonic component or to a random process with a noise component modulated by harmonic oscillations.
[17]

DAILY SOLAR MAPS AND GEOPHYSICAL GRAPHS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 12, 1976 12.51.427

[Abstract of periodical; Moscow, SOLNECHNYYE DANNYYE (Solar Data), No 4, 1976, pp 1-53, No 5, pp 1-48]

[Text] Regular data are published on solar activity on the basis of observations by observatories in the USSR, GDR, CzSSR, Rumania and the Republic of Cuba in the form of daily maps of the sun, curves of propagation of the slowly varying component of solar radioemission and tables of the numerical characteristics of those phenomena which are shown on the maps and solar radioemission.
[23]

SUNSPOT ENERGY

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 12, 1976 12.51.399

[Abstract of article by A. A. Solov'yev; Moscow, SOLNECHNYYE DANNYYE, No 4, 1976, pp 54-60, "Sunspot Energy"]

[Text] The author has computed the "bonding energy" of a sunspot $\mathcal{E}_s$, numerically equal to the change in the total energy of the photospheric and subphotospheric layers in contact with them. The bonding energy is taken as the sum of the energy of the magnetic field, the potential energy of compression of a spot tube of force and the change in the internal energy of the spot atmosphere as a result of its cooling. The spot model is taken in the form of a magnetic funnel with a constant magnetic flux at all levels and an exponential dropoff in field strength with altitude. In the computations the author uses a Bilderberg model of the photosphere. It was established that in a rather wide range of initial parameters the functions $\Delta\mathcal{E}_s$ have a distinct minimum near 2,000-2,100 oe; this agrees with the most frequently observed values of magnetic field strength in spots. Spot energy becomes stationary after five days from the moment of its formation.
[23]

BEHAVIOR OF MAGNETIC FIELDS DURING ACTIVE REGION FORMATION

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 12, 1976 12.51.395

[Abstract of article by V. M. Grigor'yev and L. V. Yermakova; Moscow, SOLNECHNYYE DANNYYE, No 4, 1976, pp 83-92, "Magnetic Field Changes During the Formation of an Active Region"]

[Text] Using observations made with a panoramic magnetograph, a study was made of changes in magnetic fields accompanying the formation of sunspot groups. The data were obtained for two groups. In both cases the formation of the groups occurred against the background of old magnetic fields. First to appear were fields coinciding in sign with the background field in this place; however, this can be an effect associated with the large entrance aperture of the magnetograph. Evidences of the appearance of a new group become conspicuous several days before its formation, but these "precursors" do not exhibit significant changes over a long period of time. The emergence of a field adequate for the formation of spots occurs in a time $\lesssim 5.5$ hours; this agrees well with the results of other researchers. The magnetic field of a new group at the time of its emergence eliminates the old magnetic fields situated in this place. Bibliography of 10 items.
[23]

SOLUTION OF TRIANGLE WITH SIDE DEFLECTED BY REFRACTION

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 12, 1976 12.51.158

[Abstract of article by K. M. Kaverznev and G. Ye. Lazarev; Moscow, ANTARKTIKA. DOKL. KOMIS., No 15, "Nauka," 1976, pp 115-125, "Solution of Triangle with a Side Deflected by Refraction"]

[Text] A study was made of a phenomenon clearly expressed for Antarctica -- refraction. On the basis of a mathematical interpretation of the Fermi principle on the propagation of light in an inhomogeneous medium, formulas are derived for the angles of refraction of both a general and a special type free of systematic errors (including for small inclinations). An integral expression is also derived for the length of the trajectory of propagation of a ray deflected by refraction. Bibliography of seven items.
[23]

THREE-BODY PROBLEM IN INDEPENDENT GENERALIZED COORDINATES

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 12, 1976 12.51.122

[Abstract of article by A. A. Yefimov; Moscow-Leningrad, PROBL. PROISKHOZHDENIYA TEL SOLNECH. SISTEMY, 1975, pp 311-324, "The Three-Body Problem in Independent Generalized Coordinates"]

[Text] In studies by the author (1974-1975) there was basic formulation of the three-body problem in generalized coordinates. Lagrangian and Hamiltonian equations were derived in these variables. However, for the sake of retaining symmetry of the differential equations, the number of generalized coordinates used was one greater than the number of degrees of freedom in the system. As a result, it was necessary to deal with a mechanical system on which was superposed an additional holonymic relationship. Although the influence of this relationship was taken into account using the undetermined Lagrangian multipliers, nevertheless the introduction of an excess generalized coordinate increased the degree of the system of differential equations by two units. In this paper the three-body problem was formulated in independent generalized coordinates. An explicit form of the Lagrange and Hamilton function in these variables was obtained.
[23]

SUCCESSES IN EXPLORATION OF SOLAR SYSTEM

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 12, 1976 12.51.24

[Abstract of article by O. Wolczek; Warsaw, POST. ASTRON., 24, No 2, 1976, pp 133-140, "Successes in Exploration of Solar System in the Light of Materials at the 18th Plenary COSPAR Conference, Varna, 25 May-7 June 1975"]

[Text] This is a brief exposition of the content of reports presented at the four sessions of COSPAR Working Group VII during the 18th Plenary Conference held at Varna during the period May-June 1975. In particular, there was discussion of the problem of lunar magnetism, the structure and composition of the Venusian atmosphere, the nature of its cloud structure. An analysis of photographs of the surface of Mercury taken by Mariner 10 is given. Also examined are the latest data on structure of the atmosphere and physical conditions on the surface of Mars according to data from the spacecraft Mars-4, Mars-5 and Mars-6, and also data on Jupiter obtained using the spacecraft Pioneer 10 and 11. Bibliography of 45 items.
[23]

BEHAVIOR OF SOLAR FLARE ELECTRONS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 12, 1976 12.51.386

[Abstract of article by V. G. Kurt; Moscow, SOLNECHNYYE DANNYYE, No 4, 1976, pp 65-70, "Statistical Patterns of Behavior of Solar Flare Electrons"]

[Text] A study was made of the correlation between increases in the intensity of nonrelativistic solar electrons and phenomena on the sun. According to data for 1972-1973, in flares of small importance ($\leqslant$1 N) there was for the most part an acceleration of electrons with an energy $\sim$30 keV in comparison with the acceleration of protons with an energy $>$30 MeV. The process of electron injection with a high degree of probability is registered on the basis of accompanying phenomena: radiobursts at fixed frequencies, rapidly drifting bursts, bursts of X radiation with an energy of several tens of keV. Fluxes of electrons from small flares ($\lesssim$100 $cm^{-2}sec^{-1}$) are registered near the earth during flares occurring in the longitude range 10-80°W. There is no dependence of the appearance of electrons on heliographic latitude of the flares. This shows that the particles generated in the latitude interval 30°S-30°N are registered identically well at the earth. The aperture of the cone of electron propagation for weak flares is 20-30°; for larger flares, up to 1B inclusive -- 40-60°. The dimension of the cone is not dependent so much on the importance of the optical flare as on its power, which it is better to determine from the power of the

radioemission in the centimeter range. The results are quite "pure' because due to relatively low solar activity there was a reliable identification of the electron fluxes with solar phenomena. Bibliography of eight items.
[23]

ANISOTROPIC COSMOLOGICAL SOLUTIONS IN GRAVITATION THEORY

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 12, 1976 12.51.802

[Abstract of preprint by A. A. Ruzmaykin; Moscow, ANISOTROPNYYE KOSMOLOGICHESKIYE RESHENIYA V TEORII TYAGOTENIYA S KVADRATICHNYMI INVARIANTAMI (Anisotropic Cosmological Solutions in the Theory of Gravitation with Quadratic Invariants), Institute of Applied Mathematics USSR Academy of Sciences, Preprint No 19, 1976, 36 pages]

[Text] The modification of the equations of general relativity theory near the cosmological singularity dictated by quantum theory can be partially realized by adding to the Lagrangian of the gravitational field terms which are quadratic relative to the curvature tensor. In such a theory in a general anisotropic case there are solutions having a regular minimum at the time t = 0. However, as shown by an analysis of very simple anisotropic metrics, they do not have a power-law asymptotic form for large t. Allowance for the logarithmic terms $R^2 \ln R$ at least in an isotropic case changes the situation little. For solution of the problem of the possibility of eliminating the cosmological singularity with a change to power-law asymptotic form it is necessary to have a self-consistent allowance for the effect of generation of particles, and possibly nonlocal terms. Bibliography of 11 items.
[23]

BLOWING AWAY OF CONDUCTIVITY ELECTRONS BY MAGNETIC FLUX

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.51.214

[Abstract of article by A. A. Yefimov; Moscow-Leningrad, PROBL. PROISKHOZHDENIYA TEL SOLNECH. SISTEMY, 1975, pp 325-330, "Blowing Away of Conductivity Electrons by a Magnetic Flux"]

[Text] The author has experimentally discovered an earlier unknown property of the magnetic field: the electrons, from the direction of the outer magnetic field, are acted upon not only by the Lorenz force directed perpendicular to the magnetic field, but also by forces in the direction of the magnetic field. It thus has been established that a magnetic line of force (at least relative to an electron) has a physically distinct direction.
[17]

STRUCTURE OF AMMONIA CLOUDS IN JOVIAN ATMOSPHERE

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 11, 1976 11.51.264DEP

[Abstract of unpublished article by M. V. Buykov, K. Yu. Ibragimov, A. M. Pirnach and L. P. Sorokina; Alma-Ata, MODELIROVANIYE STRUKTURY AMMIACHNYKH OBLAKOV V USLOVIYAKH ATMOSFERY YUPITERA (Modeling of the Structure of Ammonia Clouds in the Jovian Atmosphere), Astrophysical Institute Kazakh SSR, 1976, 40 pages]

[Text] The authors give computations of nine models of the ammonia cloud layer of Jupiter for different initial velocities of vertical ascent, turbulence coefficient, number of condensation nuclei and relative ammonia content by mass at the initial level. The article is accompanied by curves of the vertical change of such cloud layer characteristics as ammonia content, mean particle size, supersaturation, concentration and the particle size distribution on the assumption of a gamma distribution. In addition to the microphysical properties of the cloud, its optical characteristics are evaluated: scattering and attenuation functions and optical thickness. It is shown that the optical thicknesses vary in a rather broad range with transition from one model to the next. Separate consideration is given to the conditions under which the clouds can have a small optical thickness (of the order of several units) and small dimensions of the particles (0.2-0.3 μm).
[17]

INSTRUMENT FOR MEASURING FRAUNHOFER LINE POSITION

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA, No 19, MATEMATIKA-MEKHANIKA-ASTRONOMIYA in Russian No 4, 1976 pp 149-151

[Article by V. G. Nikiforov and Yu. A. Solonskiy, Leningrad State University, "Instrument for Measuring the Position of Lines in the Fraunhofer Spectrum"]

[Abstract] There has been an obvious need for creating an instrument for the rapid and convenient pointing on the central part of a spectral line with an accuracy having little dependence on the granularity of photoemulsions and having no dependence on blackening. An instrument developed and fabricated in the Solar Physics Laboratory meets these requirements. The instrument was designed on the basis of a UIM-21 universal measuring microscope with a PN-7 projection attachment. Figure 1 in the text shows the instrument optical system. A sector of the studied spectrum, projected onto a screen with a slit, is scanned at a given frequency. Directly beyond the slit is a FEU-35 photomultiplier, the signal from which is fed to an input Y of an electronic oscillograph. With feeding of a second frequency to the input X, synchronously with scanning of the spectrum

one spectral line produces on the oscillograph screen two line images -- direct and mirror. With movement of the photographic plate in the direction of spectral dispersion the images on the screen withdraw from one another or approach. By moving the measuring carriage of the UIM-21 with a micrometer screw, it is possible to match the images of the profiles of the measured spectral line. This will be the position when the investigated line is precisely pointed on the slit. A reading is made using a spiral eyepiece microscope. The design of the instrument is described in detail.
[230]

MOTION OF MARTIAN SATELLITES FROM 1877 TO 1973

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.51.106

[Abstract of article by V. A. Shor; Moscow, TRUDY IN-TA TEOR. ASTRON. AN SSSR, No 15, 1976, pp 91-113, "Motion of Martian Satellites from 1877 to 1973 and New Systems of Their Orbital Parameters"]

[Text] A study was made of the motion of Phobos and Deimos for the years 1877 -1973. The author processed more than 4,900 observations of satellites. The elements of Phobos were determined at 21 oppositions and the elements of Deimos at 25 oppositions. The secular changes of the elements were found by a comparison of the elements obtained at different oppositions. It was possible to determine new systems of parameters of the theory of motion of satellites for the first time formulated by G. Struve. The accuracy in representing the observations with the new system of parameters is above that achieved in other studies. It was confirmed that Phobos has a secular acceleration in longitude. The coefficient of the quadratic term in the longitude of Phobos is $+(0.107\pm0.011)\cdot10^{-7}$ degree/day^2. The secular acceleration of Deimos is small and is determined with a great lack of assurance. The longitudes of the satellites, computed with secular accelerations taken into account, represent the positions of satellites obtained from television photographs transmitted by the spacecraft Mariner 9. The author has found the parameters of the gravitational field of Mars and the position of its north pole, agreeing with the results of other determinations. Bibliography of 20 items.
[17]

SPECTRUM OF NOISE STORMS AND CORRELATION WITH ACTIVE REGIONS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 11, 1976 11.51.400

[Article by G. F. Yeliseyev; Moscow, SOLNECHNYYE DANNYYE, No 2, 1976 pp 52-70, "Spectrum of Continuum of Noise Storms and its Relationship to Active Regions"]

[Text] The author analyzes the relative spectra of intensity of fluctuations of the continual component of 17 noise storms registered at a frequency of 208 MHz at the Ussuriyskaya Solar Station. It was established that in most cases (10 phenomena) the relative intensity spectra are characterized by a single maximum. Such storms are usually rather stationary and are associated with active regions having low flare activity and low burst activity in the radio range. Nonstationary noise storms with high flare and burst activity have relative intensity spectra with several maxima. The following tendency is noted: in storms with high burst activity the day-to-day changes in the T_{max} periods at which the maximum intensity is observed correspond to changes in the area of the leading spot in the spot groups associated with them. At the time of low burst activity the variations in T_{max} evidently are similar to the variations in the area of the entire spot group. Bibliography of eight items.
[17]

II. METEOROLOGY

News

NOTES ON PROGRAM FOR STUDYING GLOBAL ATMOSPHERIC PROCESSES

Moscow IZVESTIYA in Russian 30 Mar 77 p 4

[Article by V. Shmyganovskiy, "To the Secrets of Weather"]

[Summary] Soviet scientists are taking an active part in the international Program for Studying Global Atmospheric Processes; the director of the Soviet part of the research is the deputy chief of the Main Administration of the Hydrometeorological Service Ye. I. Tolstikov. Recent meetings of scientists in Geneva have revealed some difficulties in implementing the program. These difficulties are associated primarily with the outfitting of the expeditions and their preparation at the national levels. For example, initially it was proposed that 50 scientific research ships would simultaneously be operating in the tropical zone; but it has not been possible to assemble such a fleet. Discussions are under way as to exactly what scale the program can assume, taking into account the funds and apparatus allocated by the participating countries. The investigations will be carried out between December 1978 and November 1979. A special phase of the observations will be carried out during the periods January-February and May-July 1979. It will involve utilization of all GARP resources: ships, satellites, buoys, aircraft and WMO stations. The two months set aside for special observations, winter and summer, will help in the collection of the maximum information; processing of the latter will require an electronic computer with a speed of 10-15 million operations per second. The experiment will be preceded by the launching of a whole series of satellites of different countries. Five of these will be launched to an altitude of 36,000 km, into a geostationary orbit. Soviet and American orbital satellites will be in lower orbits and they will transmit weather information over the entire earth. In the southern hemisphere plans call for setting out more than 300 special drifting buoys. They will transmit data on air pressure and temperature and water temperature. In addition, appropriate apparatus will be carried on hundreds of ships such as freighters and fishing vessels.
[389]

STUDIES ON ICE AND SNOW FORMATION IN CLOUDS

Moscow PRAVDA in Russian 2 Jan 77 p 6

[Article by R. Fedorov, "Small Bright Wonder"]

[Summary] The Institute of Experimental Meteorology is located in Obninsk. Here clouds are made on the earth. Warm rain clouds are created in a large chamber with a volume greater than 3,000 cubic meters, an aerosol chamber. Clouds in which ice crystals are formed are created in two temperature-pressure chambers which are relatively small, three meters in diameter, 15 meters in height. Pointed into the chambers is the objective of a television apparatus outfitted with an enlarging optical system. The field of observation is illuminated by flash bulbs. The image is registered on the film of a videomagnetic recorder. Upon completion of an experiment it is possible to see the multiply enlarged picture of the phenomena transpiring in the artificial cloud. Many studies are thus made, such as an investigation of the change in cloud transparency as moisture droplets are transformed into ice crystals. In addition, at Obninsk specialists have been making observations on the Ostankinskaya TV tower. Earlier observations at Obninsk were made on a special 300-m meteorological mast. In both cases emphasis has been on study of dangerous weather phenomena, such as fog and glaze.
[212]

USE OF LASERS FOR NAVIGATION AND ATMOSPHERIC SOUNDING

Moscow PRAVDA in Russian 14 Mar 77 p 2

[Article by V. Zuyev, Corresponding Member USSR Academy of Sciences, Director of the Institute of Atmospheric Optics Siberian Department USSR Academy of Sciences]

[Summary] On the basis of the results of fundamental investigations of the propagation of spatially limited light beams in scattering media, specialists at the Institute of Atmospheric Optics in collaboration with the special design office of scientific instrument making "Optika" of the Siberian Department USSR Academy of Sciences have developed laser navigational systems for the safe landing of aircraft under difficult meteorological conditions. With the participation of the State Scientific Research Institute of Civil Aviation they have been successfully tested at several airports. Standard equipment of this type is now being manufactured. Its broad use will undoubtedly have a significant effect. Another aspect of the problem is the diversity of the changes experienced by a laser pulse in the atmosphere. These changes can give some idea concerning the state of the atmosphere with a spatial resolution of several meters. Researchers therefore

have in their hands a powerful tool for studying phenomena in the atmosphere. The use of lasers with a great pulse repetition rate made it possible to investigate the dynamics of rapidly transpiring processes or in a short time obtain a picture of the spatial distribution of different atmospheric components. For these purposes the institute has developed generators emitting thousands and tens of thousands of pulses per second. Jointly with the "Optika" Design Office, institute specialists have developed lidars which make it possible to determine the mass concentrations of aerosols, including those of industrial origin. For the first time data have been obtained on the distribution of aerosols of different size in the surface layer of the atmosphere and on the change in the propagation of particles in the stratosphere. Methods have also been developed for determining the lower boundaries and the aggregate state of clouds. These methods and lidars have been repeatedly used in sounding of the atmosphere in a number of industrial cities. Late in 1975 in a joint Soviet-Bulgarian experiment for the sounding of industrial effluent in Sofia it was found to be possible not only to determine the mass concentration of aerosols, but also to identify them in dependence on the fuel used. During recent years the institute and the "Optika" design office have created a series of laser complexes making possible the remote measurement of temperature, humidity, wind velocity and gas components of the atmosphere, including contaminating impurities.
[377]

Abstracts of Scientific Articles

RESULTS OF INVESTIGATIONS OF HAIL PROCESSES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2B281

[Abstract of article by I. I. Gayvoronskiy, L. A. Dinevich and I. A. Khrustitskaya; Moscow, TRUDY TSENTRAL'NOY AEROLOGICHESKOY OBSERVATORII, No 104, 1976, pp 24-39, "Some Results of Investigations of Hail Processes"]

[Text] The paper gives the results of investigations of the atmospheric conditions for the development of hail processes in Moldavia and in the Crimea (data on the temperature and humidity regime in the atmosphere during thunderstorm-hail processes and also thermodynamic and aerosynoptic conditions of development in both regions). During the development of hail processes on the average the atmosphere in Moldavia is 50° colder and in the Crimea is 2° colder and has higher specific and relative humidities than on nonhail days. The thermodynamic state of the atmosphere in a hail situation, in contrast to a thunderstorm situation, is characterized by a great thickness of the convectively unstable layer and higher values of the convection level and instability energy. In these cases there is a lesser total dew point spread and a lower condensation level. Analysis of thermopressure fields on days with hail phenomena in both regions indicated that a common structure for the two of them is the presence aloft of a cyclonic curvature of the isohypses. The intensity of hail processes is determined to a considerable degree by divergence in the upper troposphere. The most dangerous hail phenomena are noted in cases when the divergence of flow at AT_{300} is 20 gpm or more. The zones of catastrophic hail falls are usually situated below a jet stream, more frequently in its delta. Bibliography of 10 items.
[390]

BACKSCATTERING FUNCTION DETERMINED FROM LIDAR OBSERVATIONS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2B286

[Abstract of article by Yu. M. Vorevodin, G. O. Zadde, G. G. Matviyenko and I. V. Samokhvalov; Novosibirsk, VOPR. LAZER. ZONDIROVANIYA ATMOSF., "Nauka," 1976, pp 45-53, "Spatial Nonuniformity of the Backscattering Coefficient According to Lidar Data"]

[Text] The article gives the results of an investigation of fluctuations of the backscattering function β and the variation factor $\Delta\beta$ by laser sounding methods for the case of haze (S_M = 10-20 km). A change in the $\bar{\beta}$ and $\Delta\beta$ values was noted in the transition region between different underlying surfaces; the fraction of the fluctuating component β changes nonproportionally to the change in β . On the path over dissected terrain the variation of $\bar{\beta}$ and $\Delta\beta$ correlates well with the trajectory profile. The temporal scales of fluctuations and the variation factors increase with approach of the sounded region of the atmosphere to the surface. The discovered patterns are attributable to the presence of stable correlations between the spatial distribution of aerosol and atmospheric diffusion. Bibliography of nine items.
[390]

DYNAMIC-STOCHASTIC EQUATIONS FOR WEATHER FORECASTING

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2B432

[Abstract of article by I. L. Vlasova and D. M. Sonechkin; Moscow, TRUDY GIDROMETEOROL. N.-I. TSENTRA SSSR, No 181, 1976, pp 8-14, "Dynamic-Stochastic Equations for Weather Forecasting"]

[Text] The weather forecasting problem is reduced to an evaluation of the distribution of the probabilities of future states of the atmosphere by integration of a system of equations of atmospheric dynamics with a known distribution of the probabilities of initial states. The authors indicate different ways to derive equations for evolution of the distribution of probabilities with time and propose ways for the practical realization of a dynamic-stochastic forecast. The first approach is useful, evidently, only for a short-range forecast; it involves a diagonalization of the covariation matrix of forecasting errors; the second is more suitable for long-range forecasting; it involves use of dynamic-stochastic analogues. Bibliography of six items.
[390]

ANALOGUE APPROACH IN DYNAMIC-STOCHASTIC WEATHER FORECASTING

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2B433

[Abstract of article by D. M. Sonechkin; Moscow, TRUDY GIDROMETEOROLOGICHESKOGO N.-I. TSENTRA SSSR, No 181, 1976, pp 15-29, "Formulation of the Problem of Dynamic-Stochastic Weather Forecasting 'By Analogues'"]

[Text] The author proposes a new method for integrating a system of prognostic equations for hydrothermodynamics of the atmosphere resistant to errors in initial data. The forecast by this method is given in two stages. First an analogue to the current state of the atmosphere is selected in the archives of long-term meteorological observations; the similarity criterion is formulated on the basis of the concepts of the theory of stability of motion. The selected analogue-process gives a first-approximation forecast. This forecast is refined by numerical integration of a system of prognostic equations linearized relative to the analogue-process. Bibliography of 13 items.
[390]

ACCURACY OF ANALOGUE APPROACH IN DYNAMIC-STOCHASTIC WEATHER FORECASTING

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2B434

[Abstract of article by A. I. Vereskov; Moscow, TRUDY GIDROMETEOROLOGICHESKOGO N.-I. TSENTRA SSSR, No 181, 1976, pp 30-40, "Analysis of the Influence of Errors in Meteorological Observations on the Accuracy of a Dynamic-Stochastic Weather Forecast by the 'Analogues' Method"]

[Text] The article gives an analysis of the stochastic process arising due to the errors in meteorological observations in the integration of a system of equations of motion perturbed relative to the analogue motion. Despite the presence of errors of observations of both the current and selected analogue state, the prediction by the analogue method ensures an unbiased evaluation of the future state of the atmosphere. The relative error in forecasting by the analogue method increases with time proportionally to the time interval between meteorological observations present in the archives. The absolute error in forecasting by the analogue method increases exponentially with time with an exponent dependent on the spectral distribution of the energy of the perturbations. Bibliography of two items.
[390]

III. OCEANOGRAPHY

News

MONOGRAPH ON PHYSICAL PRINCIPLES OF HYDROOPTICS

Minsk FIZICHESKIYE OSNOVY GIDROOPTIKI in Russian Izd-vo "Nauka i Tekhnika," 1975, 504 pages

[Abstract of monograph by A. P. Ivanov, edited by B. I. Stepanov, Academician Belorussian SSR]

[Text] From a unified point of view the author examines different optical phenomena transpiring in the seas and oceans. Since most processes in the hydrosphere are associated with light scattering, the author gives the principles of the theory of the propagation of electromagnetic radiation through a turbid medium. The methods of transfer theory are used for a quantitative analysis of the light field in a water medium and the development of methods for determining primary hydrooptical parameters. The monograph also examines the peculiarities of the energy, color, angular, spectral and polarization distributions of radiation from the sun and narrowly directed radiation sources in the sea. Much attention is given to the nonstationary scattering of radiation, the oscillating nature of the light field with a change in the properties of the hydrosphere, problems in underwater ranging and visibility. The book describes the instruments used in investigations at sea. Examples of the use of hydrooptical methods for solving different geophysical problems are considered. The book contains much reference material and specific recommendations for evaluating the radiation field in the seas and oceans. It is intended for scientific workers and specialists in the field of hydrooptical instrument making and students in advanced educational institutes specializing in the field of geophysics. Fifty tables, 151 illustrations, bibliography of 478 items.

ABRIDGED TABLE OF CONTENTS

[326]

MONOGRAPH ON FINE THERMOHALINE STRUCTURE OF OCEAN WATERS

Leningrad TONKAYA TERMOKHALINNAYA STRUKTURA VOD OKEANA in Russian Gidrometeoizdat, 1976, 184 pages

[Abstract of monograph by K. N. Fedorov]

[Abstract] This monograph is devoted to the phenomenon, discovered during the last decade, of a fine stratification of ocean waters, an investigation of the processes forming fine stratification and determining its evolution. There is a discussion of systematic problems involved in measurements of the fine structure of ocean waters. Also examined is the relationship between the fine structure (stratification) of ocean waters and such important physical processes as molecular diffusion, convection, turbulence, internal gravitational waves, inertial oscillations and currents. The monograph is intended for specialists in the field of physics of the sea and specialists in related scientific fields.

TABLE OF CONTENTS

NOTES ON TSUNAMI RESEARCH IN USSR

Moscow IZVESTIYA in Russian 5 Apr 77 p 6

[Article by A. Melik-Pashayeva, "Hunters of Tsunamis"]

[Summary] Tsunamis are generated in regions of underwater earthquakes. In order to penetrate into the "peculiarities of behavior" of tsunamis, scientists are striving to represent them in the form of models -- physical and mathematical. Physical modeling of tsunamis is in progress at Moscow State University, in the scientific laboratories of the Hydrometeorological Service and at other institutes. In one of the models the northern part of the Sea of Japan, where strong waves develop, is represented in the form of an electric field. A current is passed through it which simulates the passage of tsunami waves. The fact is that an identical form of equations describes the behavior of an electric current in an electric circuit and the flow of fluids. This investigation under the program of the Sakhalin Scientific Research Institute was carried out at the Leningrad Hydrometeorological Institute. Specialists at the Computation Center of the Siberian Department USSR Academy of Sciences have created mathematical models of the excitation of tsunami waves. It has been possible to dovetail the Novosibirsk program with computations of the propagation of tsunamis in an ocean with complex bottom relief proposed by American scientists. This resulted in the creation of an integrated complex of programs for an electronic computer makingit possible to compute the behavior of tsunamis generated by underwater earthquakes in specific regions of the Pacific Ocean. Using this information it is possible to estimate the probability of flooding of different heights along the shore exposed to tsunami waves. The first joint Soviet-American expedition for the study of tsunamis has worked in the open ocean aboard the Soviet ship "Valerian Uryvayev." The principal result of the expedition was that the shelf sectors of the floor adjacent to the shore and ending at a depth of approximately 200 m seemingly trap the energy of different oscillations of the ocean and hold it, not releasing it from the shelf zone. Along the shore the waves seemingly enter into a waveguide-trap which coincides with the boundaries of the shelf. Trapped waves are thus formed and regularly move along the Kurile Islands from north to south. These phenomena, interesting in themselves, make it possible to predict the behavior of tsunami waves if they arise in this region.
[8]

Abstracts of Scientific Articles

SYSTEM FOR PROCESSING AND ANALYZING OCEANOLOGICAL DATA

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2V23DEP

[Abstract of unpublished article by L. G. Pechisker; Kazan', VZAIMODEYSTVIYE CHELOVEKA I EVM V NAUCH. ISSLED. I UCHEB. PROTSESSE, Kazan'University, 1976, pp 58-68, "System for the Graphic Interaction of Processes for Solving Problems in the Statistical Processing and Analysis of Spatial-Temporal Series of Oceanological Data" [Manuscript deposited at the All-Union Institute of Scientific and Technical Information, 19 October 1976, No 3681-76 DEP]

[Text] The article describes an experimental system for the statistical processing and analysis of spatial-temporal series of oceanological data on the basis of the graphic interaction "experimenter-electronic computer." The graphic interaction system is constructed on the basis of a "BESM-4" electronic computer with data output on a S1-19 oscillograph supplied with a light pen. A block diagram of the system is given and its operation is described. The organization of programs for the graphic complex is discussed. The choice of programs is made using the light pen. The employed interaction strategy and the structure of data are considered.
[390]

AUTOMATIC THERMOBATHYOXYMETER

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2V52

[Abstract of article by V. A. Bublik and V. P. Korovin; Leningrad, METODY OKEANOL. ISSLED., 1976, pp 11-16, "Automatic Thermobathyoxymeter"]

[Text] The authors describe the design of an automatic thermobathyoxymeter designed for the continuous measurement of water temperature and the concentration of O_2 by depth in the layer 0-200 m and the simultaneous

registry of these parameters on the tape of an EPP-09 potentiometer and an ETsPV-3 digital voltmeter. The sounding device is lowered over the side on a RShM-6x1.5 six-strand cable. The instrument was developed in the Department of Oceanographic Instrument Making at the Leningrad Hydrometeorological Institute. Tests of the instrument were carried out on an expedition of the Leningrad Hydrometeorological Institute on board the scientific research vessel "Nerey" in the northern part of the Atlantic Ocean. The methods for carrying out the tests and their results are given. Bibliography of five items.
[390]

DETERMINING PARAMETERS OF ELECTRIC FIELD IN SEA

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2A97

[Abstract of article by V. I. Lopatnikov and V. B. Fedoseyev; Sevastopol', MOR. GIDROFIZ. ISSLED., No 3(74), 1976, pp 139-146, "Device for Determining the Vector of Electric Field Strength in the Sea"]

[Text] A study was made of a method for determining the spatial position of a marine instrument for measuring the electric field. An oriented electric field is excited in the marine medium; its components are superposed on the components of the electric field to be measured and are registered in the main measuring channel. This makes it possible to reduce the number of channels for communication with that part of the measuring apparatus which is located beyond the ship.
[390]

STRUCTURE OF BLACK SEA SEDIMENTS NEAR CRIMEA

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 233, No 3, 1977 pp 450-452

[Article by L. I. Kogan, Ya. P. Malovitskiy, V. N. Moskalenko and K. M. Shimkus, Southern Division Institute of Oceanology, "New Data on Structure of the Sedimentary Layer on the Black Sea Floor to the South of Crimea"]

[Abstract] In the course of carrying out deep seismic profiling by the reflected waves method, specialists of the Southern Division of the Institute of Oceanology in 1973-1975 did experimental work along three profiles to the south of the Crimea (as shown on a map accompanying the text). In these investigations the excitation of elastic waves was with pneumatic sources each 10-12 sec (each 25 m along the profile). The most representative data were obtained for profile I, which is discussed in detail (and

illustrated in a figure). The northwestern part of the profile corresponds to the steep part of the continental slope: the sea depth increases from 700 to 1,800 m. The central part corresponds to the lower part of the continental slope; the sea depth gradually increases from 1,800 to 2,100 m. The third sector of the profile is situated in the region of the abyssal plain. Use of the method made it possible to obtain the detailed structure of sediments to the south of the Crimea to a depth of about 8 km beneath the sea floor. It was found that the sector of the continental slope near the Crimea drops off in steps, consituting a continuation of the Crimean meganticlinorium. In the abyssal part there are structures which evidently are unrelated to the Crimea. A recent Pliocene-Quaternary complex lies with unconformity on the more ancient Mesozoic-Cenozoic structures. The catastrophic downdropping of the Black Sea floor at the end of the Miocene is confirmed. The similar cross section obtained for the Caucasus continental slope indicates that these regions have a common geological history.
[15]

NEW DATA ON ANTARCTIC CIRCUMPOLAR CURRENT

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 233, No 3, 1977 pp 473-475

[Article by P. P. Ganson, V. G. Krivosheya, V. G. Neyman and V. M. Tarasenko, Institute of Oceanology, "New Data on the Antarctic Circumpolar Current"]

[Abstract] New data on the Antarctic Circumpolar Current were collected in January-February 1975 on the 10th scientific research voyage of the "Akademik Vernadskiy" of the Ukrainian Academy of Sciences. On this voyage observations of currents were made along a profile along 20°E from 38 to 55°S using anchored buoy stations. Current direction and velocity were registered by BPV current meters in the layer from the surface to 3,500-4,000 m with a discreteness of 10 minutes at 12 horizons. It was found that the current has several "cores" in which the velocity can exceed 50 cm/sec. The southerly one was registered in the region 48°S. Easterly transport was registered here in the entire layer investigated (0-3,700 m). There is basis for postulating that no westerly countercurrent exists in the bottom layer. The vertical velocity profiles in the northerly core were substantially different from the corresponding profiles in the southerly core. The greatest differences were noted in the profiles of the meridional component. A considerable velocity of the Antarctic Circumpolar Current was discovered: as much as 80-100 cm/sec. The velocity increase in the northerly core in comparison with the southerly core occurs due to an increase in the meridional current component. This impairment in zonality in the northern part of the current evidently occurs under the influence of peculiarities of atmospheric circulation in this region.
[15]

IV. TERRESTRIAL GEOPHYSICS

News

MONOGRAPH ON THEORETICAL GRAVIMETRY

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA in Russian No 1, 1977 1.52.49K

[Abstract of monograph by D. V. Zagrebin; Leningrad, VVEDENIYE V TEORETICHESKUYU GRAVIMETRIYU (Introduction to Theoretical Gravimetry), "Nauka," 1976, 292 pages]

[Text] This book consists of two parts: 1. Fundamental Principles of Higher Geodesy (Chapters 1-5); 2. General Principles of Theoretical Gravimetry (Chapters 6-10). Content of chapters: 1. Historical Information on Study of the Figure and Dimensions of the Earth; 2. Gravity and its Potential Function; 3. Normal Component of the Earth's Gravitational Field; 4. Principles of Geodetic Gravitation; 5. Gravity Reduction and the Problem of Regularization of the Earth; 6. Figures of Celestial Bodies; 7. Lamé Functions; 8. Figures of Equilibrium of a Rotating Homogeneous Fluid; 9. Ellipsoidal Geoid, Selenoid and Areoid; 10. Regularized Geoid. Bibliography of 92 items.
[31]

INSTITUTE COMPILES TECTONIC MAP OF FAR EAST

Moscow PRAVDA in Russian 11 Mar 77 p 6

[Article by Z. Klyuchikov, "Toward Untouched Treasures"]

[Text] Scientists of the Institute of Tectonics and Geophysics of the Far Eastern Scientific Center USSR Academy of Sciences have compiled a tectonic map of the Far East.

On sheets of drafting paper we see enormous expanses of land and sea covered with bright bands and patterns of different configurations. It seems that the rainbow has been splashed here in all its colors and hues. That is how beautiful the tectonic map of the Far East looks. It has been compiled for the first time in our country. It depicts information, accumulated over a period of many years, on the structure and development of the earth's crust. The map can serve as a sort of compass pointing the way to new mineral deposits.

The director of the institute, Academician Yu. Kosygin, states: "In our day we limit ourselves to a study of the earth's surface in the search for natural wealth; that means that to a considerable degree we are groping in the dark. The reserves of so-called easily discovered deposits are almost exhausted. Now it is necessary to penetrate into the deeper horizons. This will make it possible to clarify the pattern of distribution of underground treasures, to ascertain rational directions for their search, and those are the tasks of our institute."

The Far East is a convenient polygon for such investigations. This is one of the few regions on the planet where geological processes transpire most actively. Here come together two extremely large blocks of the earth's crust -- continental and oceanic -- separated by deep faults. Along these faults volcanic lavas and ore solutions from which new deposits are formed rise to the surface.

The map compiled by the institute will serve as a sort of window into underground secrets. It shows what geological bodies are situated there, their composition and age, the sequence of bedding of rocks. Now by means of the collected materials it is possible to determine the patterns of distribution of deposits of a number of metals in the territory of the Far East.

The Khabarovsk Institute of Tectonics and Geophysics is still relatively young. Only five years have elapsed since the day of its formation.

"Institute personnel have prepared more than 300 scientific studies," reports the director. "These studies cover different processes and phenomena transpiring in the deep layers of the earth, the problems in formation and patterns of distribution of minerals. First of all, work is being done on problems of fundamental science, but practical problems are not being left to one side. The final and principal objective is to facilitate the speedy exploitation of natural wealth and the development of productive forces in the Far East."

A chain of active volcanoes extends for many thousands of kilometers along the boundary of the continent. Here tsunamis are generated in the ocean. Frequent earthquakes occur. Is it possible to lessen these calamities and learn to control them? In order to solve this problem it is first

necessary to know the mechanisms responsible for these calamities, the foci of whose occurrence lie at a great depth. The specialists at the institute have developed a new method for investigating active zones in the Pacific Ocean belt. It makes it possible to create a model of the deep structure of the earth's crust on the basis of the characteristics of seismic waves from small earthquakes and to process the results with electronic computers.

In our country much attention is being devoted to study of the processes transpiring in the mantle by means of xenoliths -- impregnations of minerals in basaltic rocks. An important contribution to solution of this problem has been made by scientists of the division of regional and applied tectonics. They have discovered a new type of movement of mantle matter. This can assist in clearer representation of possible mechanisms of formation of magma, which to a large extent remain mysterious. And indeed it is known that most deep deposits of ore bodies are associated with magmatic rocks. [370]

TASS REPORTS EARTHQUAKE IN RUMANIA

Moscow PRAVDA in Russian 6 Mar 77 p 5

[TASS Report: "Strong Earthquake"]

[Summary] Bucharest, 5 March. On 4 March at 2122 hours local time a strong earthquake occurred in Rumania. The earthquake affected primarily the southeastern part of the country. There are human victims and great material losses have been inflicted. All the resources of Rumania have been directed to rectifying the results of the earthquake and rendering assistance to the victims. The objective is to restore at once the supply of the afflicted cities and towns with water and electricity and to ensure an uninterrupted food supply. The population of the capital is exhibiting great courage and discipline. Calm and order prevails in the city despite the serious losses to human life and property. All factories and enterprises are operating normally. A visit in the city revealed fires being extinguished and rubble being cleared away from the streets and sidewalks. Some parts of the city were declared off limits...Sofia, Bulgaria, 5 March. An earthquake with an intensity from 6 to 12 on the scale was registered in Bulgaria on Friday. It was felt most strongly in Svishtov and Ruse in the northeastern part of the country. There were human and property losses. Budapest, 5 March. Small tremors were registered in the Hungarian capital and also in the eastern regions of the country. Belgrade, Yugoslavia, 5 March. Underground tremors, whose epicenter is situated in Rumania, were felt yesterday over almost the entire territory of Yugoslavia. The earthquake did not cause significant property damage, but a few people were slightly injured. [348]

NOTES ON EARTHQUAKE DISTRIBUTION

Baku VYSHKA in Russian 14 Dec 76 p 4

[Article by V. Barsukov, "Are Earthquakes Random?"]

[Summary] Most destructive earthquakes during recent years have occurred either near the equator or in the zone 35-40° north and south. One of the hypotheses explaining this phenomenon is that 400 million years ago the formation of mountains ended and there was a rapid shifting of the poles and accordingly there was a shifting of the earth's axis of rotation. The north magnetic pole, which was then situated in Western Australia, moved to a point to the east of Japan. About 200 million years ago, when the Andes and Cordilleras, Urals and Pamirs were formed, the pole again moved from the northern part of the Pacific Ocean, occupying approximately its present-day position. According to this hypothesis, the next movement of the poles and a corresponding displacement of climatic zones should be expected at the present time. Each significant movement of the pole results in adaptation of the figure of the earth to the new position of its axis of rotation, which is accompanied by horizontal and vertical movements of individual blocks of the earth's crust. There is also a change in the linear velocities of rotation of different zones on the earth. All this cannot but cause very great horizontal stresses of the earth's crust, and as a result, earthquakes. At the same time, adaptation of the figure of the earth to the new position of its axis of rotation causes particularly strong stresses in different latitude ranges. According to the "critical parallels" hypothesis, the equator and the parallels 35 and 62° north and south are considered most important. But intensive tectonic movements are observed at other latitudes as well. But during the last five-ten years most large earthquakes have occurred either in the equatorial zone or in the zone 35-40° north and south. If these hypotheses are true, in the near future it is impossible to expect a lessening of the intensity of geological processes and earthquakes. Moreover, earthquake intensity may increase. That is why a special earthquake prediction service should be created in seismically dangerous regions. As shown by experiments carried out during the last decade, the carrying out of joint geochemical and geophysical investigations will make it possible to create a reliable scientific basis for organizing an earthquake prediction service in seismically active regions.
[339]

EXPEDITION TO EPICENTER OF TURKESTAN RANGE EARTHQUAKE

Frunze SOVETSKAYA KIRGIZIYA in Russian 12 Feb 77 p 4

[Article by A. Lazarev, "Mission to the Epicenter"]

[Summary] At $20^h26^m12^s$ on the last day of January the instruments at the Frunze Seismic Station registered an earthquake with coordinates in the outliers of the Turkestanskiy and Alayskiy Ranges; the intensity was 7-8 on the scale. Within an hour specialists of the Institute of Seismology of the Kirgiz Academy of Sciences had collected data from all stations in the republic. The focal region was pinned down: Batken-Isfara. By two in the morning the parameters had been refined. Immediate plans were developed for an expedition to the epicentral region for finding dislocations and ascertaining other earthquake parameters. The expedition covered a distance of over a thousand kilometers by road setting up seismic stations and laboratories. The permanent seismic stations Artik, Arslanbob and Sufi-Kurgan registered much information, but a thorough study of the epicentral zone required fuller coverage and use of more sensitive instruments. By the morning of 3 February the epicenter was ringed by seismic stations and laboratories. Detachments fanned out to make surveys along radial routes in order to ascertain the effects of the first, strongest tremor. The region of the Batken-Isfara earthquake has already been studied by specialists of Kirgizia, Uzbekistan, Tadzhikistan and Kazakhstan. Their work is coordinated by an interdepartmental council on seismology and seismic-resistant construction. At Frunze specialists researched the archives and concluded the first impression was correct: the Severo-Katranskiy regional fault had been rejuvenated.
[340]

REPORT FROM MOSCOW SEISMIC STATION ON RUMANIAN EARTHQUAKE

Moscow PRAVDA in Russian 6 Mar 77 p 6

[Article by V. Gubarev, "Echo of a Shock"]

[Summary] The Moscow Central Seismic Station registered a significant earthquake at 22 hours 24 minutes 40 seconds on 5 March. Corresponding Member USSR Academy of Sciences Ye. F. Savarenskiy saw that the chandeliers swung and guessed the earthquake intensity at 3-4. This is rather unusual for Moscow (Savarenskiy recalled two such tremors in 1940). A report from Odessa stated that there was no destruction, although cracks appeared in plaster. At Kishinev the tremor was 7 scale units, at Sochi -- 3, at Tula -- 3-4, at Leningrad -- 3-4. The main blow was inflicted on populated places in Rumania. Specialists noted that the tremor was felt most by those in buildings constructed on unconsolidated ground and by those in the upper stories of tall buildings. In Moscow in the high buildings some clocks stopped and furniture moved. The region where the earthquake was felt was extensive because the seismic focus was deep. The focus was at a depth of 100 to 150 km. The "Carpathian focus" responsible for this event is active at an interval of 50-100 years. The time of this event could not be predicted, although the existence of the focus was known. And even its intensity could be determined in advance. For example, the construction of buildings in Kishinev was designed to withstand a 7-unit earthquake.
[349]

Abstracts of Scientific Articles

MAGNETOVARIATION RESEARCH IN HIGH LATITUDES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2A44

[Abstract of article by V. S. Shneyer, A. S. Shcherbakova and E. B. Faynberg; Moscow, PROSTRANSTV.-VREMEN. STRUKTURA GEOMAGNIT. POLYA, "Nauka," 1976, pp 99-107, "Magnetovariation Research in Regions of High-Latitude Ocean Areas"]

[Text] The authors carried out an analysis of the field of geomagnetic variations on the basis of data from nine stations located near the shore and on islands in the Barents and Norwegian Seas in the region of auroral activity. It was possible to discriminate characteristic maxima in the spectra at stations located on peninsulas. Vize-Parkinson vectors and magnetic polar diagrams were constructed for the purpose of analysis of the internal part of the field. The influence of the shoreline, continental slope and tectonic dislocations on the field of variations of geoelectric inhomogeneities was clarified. A geomorphological interpretation is given. Even near the source of variations (auroral electrojet) the Vize-Parkinson method is suitable for the detection of magnetovariation anomalies. Bibliography of nine items.
[390]

CLASSIFICATION OF DISPLACEMENTS OF EARTHQUAKE FOCI

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 3, 1977 pp 103-109

[Article by L. Yu. Vermisheva and A. A. Gangnus, Institute of Physics of the Earth, "Application of Classification of Displacements at the Foci of Earthquakes for the Solution of Seismotectonic Problems"]

[Abstract] A rigorous classification of mechanisms must be introduced for a statistical and seismotectonic analysis of the data accumulated by seismologists on the mechanisms of earthquake foci. The classification of earthquake mechanisms considered in this paper makes it possible to obtain stable characteristics of the field of stresses and displacements in the seismic region expressed in a form convenient for comparative analysis. With transition from weak to strong earthquakes there is a clear expression of the main type of mechanism reflecting the most general tectonic patterns. Using the published classification it is possible to separate weak earthquakes into relatively random events with a complicated geometry of the foci -- minor background tremors and more regular tremors transpiring in conformity to the same types of mechanisms as the strong earthquakes. The possibility of such a separation is important for the purposes of predicting strong earthquakes with $K \geqslant 13$.
[32]

RELIABILITY OF SEISMOGRAPHS OPERATING IN STAND-BY REGIME

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 3, 1977 pp 117-120

[Article by B. M. Turdumatov and V. M. Fremd, Institute of Physics of the Earth, "Reliability of Seismographs Operating in a Stand-by Regime"]

[Abstract] The reliability of seismographs operating in a stand-by regime is determined by the reliability of their components and can be evaluated using the mean time of faultless operation, which is dependent on the intensity of instrument operation. On the basis of the theory of reliability the author has derived formulas making it possible to estimate the time of faultless operation for instruments constantly in a state of readiness with relatively short periods of operation randomly distributed in time. On the basis of data from the network of stand-by seismographs registering the aftershocks of the Dagestan earthquake of 14 May 1970 it was possible to compute the reliability of automatic seismic oscillographs. The mean time of faultless operation of these instruments was about 120 hours with an intensity of operation of 0.14 triggerings/hour. It was found that the monthly interval between control calibrations of stand-by seismographs with ISO-IIM oscillographs is optimum with respect to the reliability of these seismographs.
[32]

USE OF SPHERICAL HARMONIC ANALYSIS IN GEOMAGNETIC RESEARCH

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 1, 1977 pp 65-68

[Article by N. P. Ben'kova, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Some Applications of Spherical Harmonic Analysis in Geomagnetic Research"]

[Abstract] Spherical harmonic analysis (SHA) makes it possible to approximate (in many cases quite well) the observed spatial-temporal distribution of the field and thus serves as its empirical model; it gives information on the general properties of the field and a quantitative evaluation of the parameters of sources and the medium and therefore has the qualities of a physical model. This article gives two examples of the use of spherical harmonic analysis in geomagnetic investigations: I) spherical harmonic analysis of the field of magnetic storms and its use for evaluating the external and internal current systems and II) modeling of the main geomagnetic field on the basis of satellite data. The scientific importance of magnetic spherical harmonic analyses is now very diversified: they are the only method for processing and generalizing satellite measurements at different altitudes; they are used extensively in a study of evolution of the geomagnetic field, its spectral properties and in constructing the global normal field; they are an indispensable part of space research.
[252]

INVESTIGATION OF PECULIARITIES OF THE EARTH'S FIGURE

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA in Russian No 1, 1977 1.52.66

[Abstract of article by V. B. Buzuk; Novosibirsk, TRUDY NOVOSIB. IN-TA INZH. GEOD., AEROFOTOS"YEMKI I KARTOGR., 34, 1975, pp 3-9, "Investigation of Peculiarities of the Figure of the Earth on the Basis of Gravimetric Data Using Planetary Characteristics"]

[Text] The author describes a method for computing the heights of the quasigeoid and the components of plumb-line deflections on the basis of gravity anomalies with separation of the planetary part caused by the influence of the principal peculiarities of structure and the figure of the earth and subsequent integration of residual anomalies using the Molodenskiy or Stokes and Vening-Meinesz formulas in a region measuring 20 x 20° with the investigated point at the center and for the remaining part of the earth's surface. Formulas are given and the author discusses methods for determining the three terms which represent the height of the quasigeoid and the components of plumb-line deflection at the investigated point. Bibliography of nine items.
[31]

USE OF SPACE METHODS IN CARTOGRAPHY AND GEOGRAPHY

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA, OTDEL'NYY VYPUSK No 1, 1977 1.52.147

[Abstract of article by V. I. Kravtsova; Moscow, KARTOGRAFIYA. T. 7 (ITOGI NAUKI I TEKHN. VINITI AN SSSR), 1976, pp 167-182, "Use of Space Methods in Cartography and Geographic Research"]

[Text] This is a review of published materials on the use of space methods for investigating the earth. The materials are systematized in the following directions: evaluation of space surveys as sources for compiling maps and in geographical research; improvement in methods for making surveys from space; preliminary processing of photographs; work on methodological and technical interpretation problems; formulation of methods for using space surveys in different branches of geographic research and special mapping; preparation of frames for work with space photographs; exchange of research experience, holding of conferences, issuance of generalizing publications. Bibliography of 55 items.
[31]

PATENT FOR DEVICE FOR DETERMINING GRAVIMETRIC CONSTANT

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.52.74P

[Abstract of patent by M. V. Barkan, A. A. Gerkus and V. G. Smirnov; Moscow, Author's Certificate USSR, No 499542 (No 1767155), published 24 March 1976, "Device for Determining Gravimetric Constant"]

[Text] The patent describes a device for relative measurements of the acceleration of gravity on a moving base and the registry of horizontal disturbing accelerations. Two horizontal strings distend a ferromagnetic mass which is held by means of a biaxial magnetic suspension. The suspension is mounted on a platform whose axis of rotation coincides with the direction of measurements. The use of filtering and correcting electric circuits for controlling operation of the suspension makes it possible to compensate the influence of the disturbances caused by vertical and horizontal accelerations, the ship's rolling, vibrations, etc.
[31]

STRATIFICATION OF LOWER LAYER OF ATMOSPHERE AT NEGATIVE TEMPERATURES

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA, OTDEL'NYY VYPUSK in Russian No 12, 1976 12.52.41

[Abstract of article by V. K. Pisarenko; --, GEOD., KARTOGR. I AEROFOTOS"YEMKA. RESP. MEZHVED. NAUCH.-TEKHN. SB., No 24, 1976, pp 93-97, "Determination of Stratification of the 200-m Layer of the Atmosphere at Negative Temperatures"]

[Text] The article gives a classification of quantitative changes in negative air temperatures in the lower 200-m layer of the atmosphere. It is proposed that atmospheric stratification be determined from solar altitude, lower-level cloud cover and wind velocity at a height of 25 m above the ground surface. The reliability of the proposed classification was checked using the Pearson chi-square test. The Weibull distribution was used as a theoretical distribution. A statistical analysis of 432 temperature profiles revealed that in general the classification correctly reflects the actual change in air temperature in the 200-m layer of the atmosphere: an isothermal state is established with a probability of 0.92, an inversion distribution with a probability of 0.66, and a temperature decrease with a probability of 0.82. Bibliography of five items.
[392]

DETERMINING MOST PROBABLE FIGURE OF SOLAR DISK

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA, OTDEL'NYY VYPUSK No 12, 1976 12.52.77

[Abstract of article by I. G. Kolchinskiy, A. V. Arkhangel'skiy and V. V. Kirichuk; --, GEOD., KARTOGR. I AEROFOTOS"YEMKA. RESP. MEZHVED. NAUCH.-TEKHN. SB., No 24, 1976, pp 30-36, "Construction of the Most Probable Figure of the Apparent Solar Disk from its Photoimage"]

[Text] The use of solar photoimages for determining astronomical refraction (see RefZh., 1976, 7.51.179) and its anomalies requires the solution of two problems: choice of the curve best corresponding to the apparent form of the photoimage of the solar disk and orientation of the solar photoimage on the measurement instrument relative to its coordinate axes. The authors analytically examine the refraction deformation of the apparent solar disk for $z \geqslant 80°$ and give formulas for computing the difference of solar semidiameters. It is shown that the figure obtained when photographing the solar disk is not an ellipse but constitutes two different curves which undergo smooth transition into one another. An instrumental method is proposed for orienting the solar image on the measuring instrument. Bibliography of eight items.
[392]

LASER INTERFEROMETERS FOR STUDYING SURFACE DEFORMATIONS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2G7K

[Abstract of preprint by M. N. Dubrov; Moscow, DLINNOBAZOVYYE LAZERNYYE INTERFEROMETRY DLYA IZUCHENIYA DEFORMATSIY ZEMNOY POVERKHNOSTI (Long-Base Laser Interferometers for Study of Deformations of the Earth's Surface), Institute of Radio Engineering and Electronics USSR Academy of Sciences, Preprint No 15(221), 1976, 26 pages]

[Text] The article cited above gives the results of investigations leading to the creation of laser instruments capable of registering deformations of the earth's crust under the influence of remote earthquakes and other geophysical processes. The article gives a description of two air-filled interferometers with a length of about 100 m, the frequency-stabilized lasers employed and the recording devices; the response of the instruments to deformations is no worse than 10^{-10} relative unit. The noise introduced by the air medium varies in the range $2 \cdot 10^{-10}$-$3 \cdot 10^{-9}$ over a period of a year. The interferometers were used in making measurements demonstrating the possibilities of the instruments.
[390]

PATENT FOR NEW GRAVIMETER

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2G305P

[Abstract of patent awarded to D. G. Gridnev; Moscow, Author's Certificate USSR, No 305438 (No 1274211), published 6 February 1976, "Gravimeter"]

[Text] In this gravimeter with horizontal torsion fibers for excluding null-point drift it is proposed that the pendulum be suspended not only on twisted horizontal fibers, but that cylindrical springs be used as well. In this case the elastic moment of the fibers is opposite the elastic moment of the springs. At the same time, the null-point drift is dependent on the relationship of the moments of the fibers and springs. The angles of twisting of the fibers and springs are selected in such a way that for all practical purposes it is possible to achieve a position in which gravimeter null-point shift will be absent.
[390]

METHOD FOR DETERMINING TIME OF EARTHQUAKE OCCURRENCE

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2G166P

[Abstract of patent awarded to S. S. Sardarov; Moscow, Author's Certificate USSR, No 507844 (No 1998903), published 16 April 1976, "Method for the Prediction of the Time of Earthquake Occurrence"]

[Text] This method for predicting the time of occurrence of an earthquake in a seismically active region involves the periodic measurement, at places of rock fracturing, of the concentrations of radiogenic gases in the gaseous and liquid phases and the subsequent determination of their ratios, for example, He/Ar^{40}. For the purpose of increasing the accuracy and reliability of the method, the heat flow is also measured and on the basis of a sharp change in the variation of the periodicity of the determined values a judgment is made concerning the time of earthquake occurrence.
[390]

GEOPHYSICAL INVESTIGATIONS OF CRUST IN SIBERIA

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2G57

[Abstract of article by E. E. Fotiadi; Novosibirsk, METODIKA I REZUL'TATY KOMPLEKS. GEOFIZ. ISSLED. ZEMN. KORY SIBIRI, 1976, pp 5-12, "Complex Geophysical Investigations of the Earth's Crust in Siberia (Based on Studies of the Division of Potential Fields of the Institute of Geology and Geophysics Siberian Department USSR Academy of Sciences in the Ninth Five-Year Plan)"]

[Text] The article characterizes the principal directions in work: 1) study of structure of the earth's crust and upper mantle in the territory of Siberia by a complex of geophysical methods; 2) development of gravimetric, magnetometric and electromagnetic methods for investigating the deep structure of the earth. Data from control deep seismic profiles were used in constructing a petrophysical model of structure of the earth's crust on the basis of geological-geophysical data. It is noted that in the analysis of the complex of geological-geophysical data there is a need for a changeover from the study of individual areas to a study of great territories in Siberia and the Far East. Special attention is devoted to an analysis of the present-day isostatic state of the earth's crust in individual regions of Siberia. The relationships between geological structure and geophysical fields are discussed.
[390]

MEASUREMENTS OF GRAVITY INCREMENT WITH SHARP GRAVIMETERS

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA in Russian No 11, 1976 11.52.107

[Abstract of article by R. B. Rukavishnikov; Moscow, REZUL'TATY ISSLED. PO ETALONIROVANIYU GRAVIMETROV, "Sov. Radio," 1976, pp 21-26, "Measurements of the Gravity Increment Using CG-2 (Sharp) Gravimeters in a Control Polygon"]

[Text] Using screws only for the small range, several Sharp gravimeters were used in making measurements in the Pavlovo-Vodenitsata Control Polygon (Bulgaria) with a difference $\Delta g \sim 65$ mgal. The results of the measurements were processed using the values of the graduation coefficients obtained in Bulgarian territories not long before field measurements. The measured Δg values were reduced to a common temperature. It was found that the total error in the connection made using a group of gravimeters in several runs was equal to approximately $\pm 16 \mu$gal. The error in determining Δg with one instrument in several runs exceeds the error in determining Δg in one run by a group of instruments. In order to reduce measurement errors with gravimeters of this type it is recommended that a constancy of the temperature in the medium in which the instrument is situated at the time of field work be ensured or that temperature changes be taken into account. Bibliography of 11 items.
[331]

USE OF ELECTROMECHANICAL FEEDBACK IN SEISMIC DETECTORS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2D196

[Abstract of article by L. K. Shvedchikov; Moscow, PRIKLADNAYA GEOFIZIKA, No 84, "Nedra," 1976, pp 107-114, "Use of an Electromechanical Feedback in Low-Frequency Seismic Detectors"]

[Text] The article examines the influence of an electromechanical feedback proportional to the integral of relative displacement of the moving mass of a seismic detector on its frequency-amplitude and phase characteristics. It is shown that the use of this feedback leads to a broadening of the seismic detector passband in the low-frequency region without a change in its mechanical stability.
[390]

COMBINED USE OF GEOPHYSICAL METHODS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2D151

[Abstract of article by V. V. Brodovoy; Moscow, KOMPLEKSIROVANIYE GEOFIZ. METODOV PRI RESHENII GEOL. ZADACH, "Nedra," 1976, pp 30-41, "General Information on Geophysical Methods and Principles for Their Combined Use. Principles for Combining Geophysical Methods"]

[Text] The author defines the essence of the combining of geophysical methods, its physical and economic basis, the problems and peculiarities in different stages of geological investigations. In regional investigations the leading role is played by gravimagnetoelectrometric surveys carried out in a definite sequence in combination with deep seismic sounding, drilling of reference and parametric boreholes. In the exploration of deposits the leading method is electrical prospecting. Underground exploration methods (shafts and boreholes) and nuclear physics methods of study and testing are acquiring great importance. The objectives of a combined system in the exploration stage are given for some types of minerals.
[390]

DEEP STRUCTURE AND SEISMICITY OF ARMENIA

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2G220

[Abstract of article by G. V. Yegorkina, I. A. Sokolova, L. M. Yegorova, I. V. Garetovskaya, V. A. Rakitov and T. D. Dvoskina; Moscow, SOSTOYANIYE I PERSPEKTIVY RAZVITIYA METODOV POPERECH. I OBMEN. VOLN V SEYSMORAZVEDKE, 1976, pp 114-124, "Some Problems in the Methods for Study of the Deep Structure and Seismicity of Armenia Using 'Zemlya' Apparatus"]

[Text] In this article the authors describe the methods used in observations and interpretation of data obtained by the earthquake exchange waves method in the example of investigations in Armenia. The authors define the problems solved using different classes of waves -- longitudinal, transverse and exchange, from distant and close earthquakes and from large shots. There is a brief description of the methodological characteristics of processing of materials for each part of the information. An analysis of the combination of all available data makes it possible to obtain a deep cross section of the earth's crust, the velocity characteristics of the cross section, the distribution of earthquake foci in area and in depth, location of faults and their probable depth, nature of the stressed state of the earth's crust and the regional seismicity regime. As an example, the article gives a deep cross section along the profile Markara-Poyly and a map of the surface of

the basement in Armenia. The earth's crust in this region is a sharply stratified medium with horizontal discontinuities of the first kind and with the presence of some number of individual quite large blocks of the earth's crust.
[390]

METHOD FOR SOLVING THE THREE-DIMENSIONAL INVERSE GRAVITATIONAL PROBLEM

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 1, 1977 pp 89-100

[Article by P. I. Balk, Irkutsk State University, "On the Theory of the Selection Method in Solving the Three-Dimensional Inverse Gravitational Problem"]

[Abstract] In connection with the general problem of defining and describing new classes of possible solutions of the direct and inverse problems in gravimetry, the author gives an analytical solution of the direct problem in a class of parabolic semicylinders in which the distribution of densities is described by the polynomial law. Accepting the general concept of an approximative approach in the solution of inverse problems as the fundamental idea, within the framework of the introduced class of field sources the author has formulated quite universal algorithms for the quantitative interpretation of gravitational anomalies within the scope of the selection method. The formulation of the algorithms, in particular, provides for the joint interpretation of different kinds of gravimetric material.
[29]

MAGNETIC HORIZONS IN PECHORA BASIN DEPOSITS

Moscow IZVESTIYA AN SSSR, SERIYA GEOLOGICHESKAYA in Russian No 3, 1977 pp 130-132

[Article by V. I. Belkin, Pechora Geophysical Expedition, Geology Ministry Russian Soviet Federative Socialist Republic, "Magnetic Horizons of Upper Permian and Triassic Deposits of the Pechora Basin"]

[Abstract] During 1970-1975 specialists of the Pechora Geophysical Expedition carried out a study of the magnetic susceptability of rocks in the Pechora basin. Determinations of magnetic susceptability were made for 9,228 samples, including 8,431 samples from Permian and Triassic deposits. The testing was carried out layer-by-layer from the cores of 21 boreholes and for thick layers, with an interval of one meter. These investigations made it possible to date roughly the principal events in the tectonic history of the Far North in the Urals and Cisuralia: the time of completion of erosion of the sedimentary cover in the cordillera zone -- middle of the

Upper Permian; time of maximum rising of the cordilleras -- Early Triassic; time of leveling-out of relief in the region of the mountain structures of the Paleourals -- Middle Triassic. The peneplanation of the Hercynian Urals occurred long before the end of the Triassic period.
[18]

QUASIHARMONIC OSCILLATIONS OF MICROSEISMIC BACKGROUND

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 232, No 3, 1977 pp 558-561, "Quasiharmonic Oscillations of the Microseismic Background in the Frequency Range 1-5 Hz"]

[Abstract] This paper gives the spectral characteristics of the microseismic background in the frequency range 0.5-5 Hz and the results of their investigation. The data used were registered at a distance of 100 km from Moscow and not less than 10 km from such sources of seismic interference as highways and railroads, large populated places and electric power lines. It was found that in the microseismic background in the frequency range 1-5 Hz there are regular quasiharmonic oscillations at frequencies of 1.05, 1.36, 1.67, 2.08, 2.52, 2.77 and 3.13 Hz with amplitudes of about $(1-8)\cdot 10^{-4}$ m. In the course of time intervals of about one hour the regular oscillations are stable in frequency and amplitude. Changes in their frequencies in the course of a day attain $1.2\cdot 10^{-2}$ Hz, whereas the annual oscillations are twice as great. Changes in the amplitudes in the course of a day occur differently for different components. The diurnal and annual changes of the noise component do not exceed 30% and the hourly oscillations are ±2%. The presence of regular quasiharmonic oscillations in the microseismic background indicates the existence of sources of oscillations with a high stability in frequency and amplitude in a time interval of about one hour or more.
[227]

SEISMIC PROSPECTING IN SEDIMENTS ON SIBERIAN PLATFORM

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 11, 1976 pp 103-111

[Article by V. L. Kuznetsov, V. F. Nikishina and V. G. Sibgatullin, Siberian Scientific Research Institute of Geology, Geophysics and Minerals, "On Increasing the Effectiveness of Seismic Prospecting in the Regional Study of the Sediments on the Siberian Platform"]

[Abstract] The authors propose a method for increasing the effectiveness of seismic prospecting in studying the sedimentary cover of the Tungusskaya syneclise on a regional basis. It is based on the combining of continuous profiling by the reflected waves method with point seismic soundings

with waves of different types (refracted, supercritical reflected and refracted). It is shown that the data from each of these methods do not overlap, but supplement one another, considerably enriching the cross section of seismic discontinuities. Sounding data give information on the boundary velocities of the sedimentary strata (which is particularly important when there is a block structure of the medium). In addition, there is an increase in the reliability of data on the structure of the sedimentary cover on a regional scale. Additional information is also obtained on wave propagation velocities from such soundings. Such data can be important when it is difficult to trace reflected waves during continuous profiling. Thus, the use of a combination of seismic observations considerably augments the effectiveness of seismic prospecting in the sedimentary deposits of the Siberian platform.
[251]

BREAKDOWN OF SPECTRUM OF MICROSEISMS

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 11, 1976 pp 112-118

[Article by G. V. Anikanova and V. N. Tabulevich, Institute of the Earth's Crust, Siberian Department USSR Academy of Sciences, "Separation of the Spectrum of Microseisms Registered at the Talgar and Bodon Frequency Selection Stations"]

[Abstract] Frequency-selection registry of microseismic oscillations in combination with summarized data from seismic stations of the general type created a unique possibility for the breakdown of the microseismic spectrum into parts corresponding to individual sources. For example, it is shown that the records for Talgar station are caused by the simultaneous operation of three sources of microseisms -- over Lake Issyk-Kul' -- 1.5-2.5 sec, the Atlantic -- 5-7 sec, and over the Caspian -- 4 sec. Records from Bodon station show the simultaneous effect of a source of microseisms over Lake Baykal with periods 1-2.5 sec, over the Pacific Ocean with periods 5-6 sec and over the Atlantic -- 5-6 sec. The possibility of a reliable separation of two sources having one and the same frequency appeared only as a result of use of a frequency selection seismic station. Tracing of the trajectories of sources of generation of microseisms on the basis of data from frequency selection stations on a systematic basis would make it possible to study the formation of disturbances for water bodies which cannot be observed directly and thus would be of great hydrometeorological importance.
[251]

GAK GRAVIMETERS USED FOR MEASURING SMALL GRAVITY INCREMENTS

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA, OTDEL'NYY VYPUSK in Russian No 11, 1976 11.52.108

[Abstract of article by R. B. Rukavishnikov; Moscow, REZUL'TATY ISSLED. PO ETALONIROVANIYU GRAVIMETROV, "Sov. Radio," 1976, pp 55-59, "Measurement of Small Gravity Increments by GAK Gravimeters"]

[Text] The article gives the results of calibration by the tilts method and the results of field measurements of small gravity increments (less than 1 mgal), obtained using unthermostated astaticized GAK 7T, GR/K2 gravimeters and the thermostated VIRG 61 gravimeter. The relative error in determining the graduation for unthermostated instruments was found to be from ±3.4 to $6.3 \cdot 10^{-4}$, and for a thermostated instrument -- $\pm 0.9 \cdot 10^{-4}$. The mean square error in determining the correction for nonlinearity of the reading scale was ±0.02 mgal (for the GAK 7T and GR/K2 gravimeters) and ±0.009 mgal (for the VIRG 61). The error in measuring Δg with a group of gravimeters in several runs was found to be $\pm 11 \mu$gal; the nonclosure in the triangle is -12μgal. For a thermostated quartz astaticized gravimeter of the VIRG 61 type the determination of the graduation and field measurements of Δg were carried out with a considerably lesser error than for the unthermostated GAK 7T and GR/K2 gravimeters. Bibliography of five items.
[331]

CALIBRATION OF SHARP GRAVIMETERS BY TILTS METHOD

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA, OTDEL'NYY VYPUSK in Russian No 11, 1976 11.52.113

[Abstract of article by K. Ya. Koz'yakova; Moscow, REZUL'TATY ISSLED. PO ETALONIROVANIYU GRAVIMETROV, "Sov. Radio," 1976, pp 5-11, "Results of Calibration of Sharp (CG-2) Gravimeters by the Tilts Method"]

[Text] The article describes the results of calibration of two quartz astaticized gravimeters of the geodetic type (Nos 174 and 228) with different ambient conditions during the period 1969-1972. It was established that the relative error in the dependence of the graduations on the studied instrumental reading scale on the change in atmospheric pressure and on geographic latitude, and also the annual changes in a graduation do not exceed $\pm 1 \cdot 10^{-4} \mu$g. The graduation is not dependent on the devices used for calibration, but it is postulated that there can be systematic errors in determining a graduation caused by errors in adjusting the investigated gravimeters and errors in angle-measuring devices used for calibration by the tilts method. Bibliography of 11 items.
[331]

VELOCITY OF PROPAGATION OF TRANSVERSE WAVES STUDIED IN BOREHOLE

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 11, 1976 pp 164-168

[Article by B. A. Kanareykin, Zh. M. Somova and N. K. Tyul'kov, Siberian Scientific Research Institute of Geology, Geophysics and Minerals and Tomsk Geophysical Trust, "Velocity of Propagation of Transverse Waves on the Basis of Observations in a Deep Borehole in the Southeastern Part of the West Siberian Platform"]

[Abstract] The article gives the results of a study of the velocity of propagation of transverse waves in deposits of the sedimentary cover on the basis of data from vertical seismic profiling in a deep exploratory borehole located in the southeastern part of the West Siberian Platform. Exchange reflected and transmitted waves of the PS type were used in measuring the velocity of propagation of these waves. The experimental studies were carried out in 1973 by a seismic logging party of the Tomsk Geophysical Trust. The cross section of the sedimentary mantle penetrated by this borehole is represented by sandy-clayey deposits of the Anthropogene, Paleogene, Cretaceous and Jurassic and is typical for the petroleum and gas province of the southeastern part of the West Siberian Platform. The total thickness of sediments in this region is 2,895 m. Borehole observations were made by the vertical seismic profiling method using an SKL-62 seismic logging laboratory; reception of elastic oscillations was with a six-channel seismic probe. Oscillations were excited by TNT shots weighing 1.2 kg; the shots were set off in water-saturated ground at a depth of 8-11 m. By this method it was possible to construct a velocity diagram of the sedimentary cover to a depth of 2,500 m on the basis of the registered transverse waves.
[251]

COMPUTING GRAVITATIONAL ANOMALIES USING AIRBORNE GRAVIMETRIC SYSTEM

Kiev GEOFIZICHESKIY SBORNIK in Russian No 72, 1976 pp 82-83

[Article by Ye. N. Bezvesil'naya, Kiev Polytechnic Institute, "Determination of a Scheme for Computing Gravitational Anomalies Using an Airborne Gravimetric System"]

[Abstract] The finding of gravitational anomalies from aboard an aircraft requires a combination of different subsystems, each of them for the measurement or conversion of a signal. The unit formed by these components is an airborne gravimetric system. This article is devoted to a determination of the minimum number and functions of the subsystems making up such a system. An algorithm is presented for obtaining the output signal for the system, proportional to the gravitational anomaly. A block diagram of the system is given. It includes the following functional parts: 1) a gravimeter

for measuring the specific force f, that is, the useful component of acceleration of gravity g_z; 2) a stabilization system for geometric or analytical stabilization of the sensing element of the specific force; 3) a navigation system for determining the position coordinates and velocity of the object; 4) altimeter; 5) digital computer. An equation is cited which can be used in determining the accuracy requirements on the subsystems ensuring a stipulated accuracy in measuring the anomalies.
[249]

DETERMINING MAXIMUM POSSIBLE EARTHQUAKES IN TRANSCARPATHIA

Kiev GEOFIZICHESKIY SBORNIK in Russian No 72, 1976 pp 56-59

[Article by R. S. Pronishin, L'vov Affiliate of Mathematical Physics, Mathematics Institute Ukrainian Academy of Sciences, "Determination of Maximum Possible Earthquakes in Transcarpathia According to Instrumental Data"]

[Abstract] Five stationary seismic stations have operated in the western Ukraine since 1961. These have made possible the registry of a great number of earthquakes and the more precise determination of the coordinates of their epicenters. During the years 1961-1969 these stations recorded 62 Transcarpathian earthquakes. These data served as initial material for constructing maps of seismic activity $\overline{A}$ and maximum possible earthquakes K_{max}. First a frequency-of-recurrence curve (Fig. 1) was constructed. For the entire area of the Transcarpathians earthquakes with K = 8 or more were found to be representative. A map of epicenters (Fig. 2) was constructed for these earthquakes. It served as a basis for constructing maps of seismic activity and maximum possible earthquakes (Figures 3 and 4).
The latter map makes it possible to conclude that in Transcarpathia maximum earthquakes with $K < 14$ are possible. This is also confirmed by known earthquakes of the past whose energy did not exceed 10^{13}J.
[249]

GEOPHYSICAL STUDIES OF DEEP STRUCTURE OF BULGARIA

Kiev GEOFIZICHESKIY SBORNIK in Russian No 72, 1976 pp 60-64

[Article by Kh. Y. Dachev and I. N. Petkov, Ministry of Mineral Resources and Sofia University, Bulgarian People's Republic, "Contribution of Geophysics to Study of the Deep Structure of Bulgaria"]

[Abstract] There are three zones in Bulgaria which differ sharply with respect to the nature of the gravity field. These zones are bounded by large gravitational "steps," corresponding to deep faults. Magnetometric data also conform to a definite zonality. According to seismological data, two

regions of high seismic activity and mobility can be defined in Bulgaria. According to seismological data, the focal depth of earthquakes in Bulgaria is from 10 to 12-15 km in the north and 25-30 km in the south, indicative of crustal earthquakes. They occur primarily in the granite layer. Study of the elements of the heat field in Bulgaria in combination with seismological data and data on the recent movements of the earth's crust gives important additional data for investigating the internal processes transpiring in the earth's crust. Seismic investigations by the reflected waves method, refracted waves method and deep seismic sounding have made an important contribution to study of deep structure in Bulgaria. They are fundamental in the interpretation of gravimetric, magnetic and seismological data and also in study of the basement and breakdown of the sedimentary cover of the platform. Studies by all these and other methods have shown that the present structure of the crust in Bulgaria is a result of a prolonged and complex evolution which transpired differently in three megablocks. The deep processes transpiring within the megablocks during the Baykal, Caledonian-Hercynian and especially the Alpine tectonic cycles of development led to a significant reconstruction of the primary structure of the earth's crust, already formed in Pre-Proterozoic times.
[249]

INTEGRAL EQUATION FOR DENSITY OF SIMPLE LAYER

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.52.65

[Abstract of article by V. P. Dyukov; --, TRUDY NOVOSIB. IN-TA INZH. GEOD., AEROFOTOS"YEMKI I KARTOGR., 1975, 34, pp 17-23, "Solution of an Integral Equation for Density of a Simple Layer by the Mechanical Quadratures Method for a Model of the Earth"]

[Text] For the purpose of determining the disturbing potential of the earth the author examines an integral equation for the density of a simple layer on the earth's surface derived by Yeremeyev and Yurkina (see RefZh, 1973, 8.52.78). It is noted that the integrals entering into this equation converge absolutely. A solution of the equation is obtained using the model proposed by Yeremeyev in the form of a sphere girdled along the equator by a ridge. Since the model is a body of revolution about a polar axis and is symmetric relative to the equator, gravity anomalies and density of a simple layer are functions only of latitude. This enables the author to reduce the mentioned integral equation to a one-dimensional equation. It is proposed that a numerical solution and evaluation of stability be obtained using an approximating system of linear algebraic equations. Bibliography of nine items.
[31]

DYNAMIC PARAMETERS OF FOCI OF STRONG EARTHQUAKES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 2, 1977
pp 9-17

[Article by A. I. Zakharova and L. S. Chepkunas, Institute of Physics of the Earth, "Dynamic Parameters of Foci of Strong Earthquakes Determined from Spectra of Longitudinal Waves at 'Obninsk' Station"]

[Abstract] On the basis of the Fourier amplitude spectra of longitudinal waves for a number of strong earthquakes with $M \geqslant 7$ registered at the central seismological observatory "Obninsk" by instruments with different frequency ranges, the authors have computed the dynamic parameters of foci: seismic moment M_0, length of rupture L, reduction in stress and mean dislocation. The estimates obtained (M_0 from $0.8 \cdot 10^{26}$ to $3.4 \cdot 10^{27}$ dynes·cm, L from 50 to 224 km) were found to be in satisfactory agreement with published data for other earthquakes. A comparison of the computed M_0 and L values with data in the literature thus demonstrated the possibility of evaluating these parameters on the basis of observations at a single station outfitted with apparatus operating in a broad frequency range.
[352]

METHOD FOR SOLVING THE INVERSE PROBLEM OF MAGNETOTELLURIC SOUNDING

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 2, 1977
pp 64-70

[Article by B. S. Svetov, S. Ye. Kurginin and Ye. I. Pristavakina, Institute of Oceanology, "Possibility of Applying the Multiple Reflections Method for Solving the Inverse Problem in Magnetotelluric Sounding"]

[Abstract] The article describes a method for the quantitative interpretation of data from magnetotelluric sounding. It is based on the representation of the impedance of the natural electromagnetic field in the form of the sum of terms, each of which corresponds to one or more multiply reflected waves. In a number of very simple theoretical models the authors investigate the possibility of applying the method to an interpretation of both horizontally stratified and horizontally inhomogeneous geoelectric sections. The article demonstrates not only the fundamental possibility of breaking down the observed field into the plane waves making it up and using this breakdown in the interpretation, but also presents an effective algorithm making it possible to carry out the required breakdown.
[352]

V. UPPER ATMOSPHERE AND SPACE RESEARCH

News

TASS ANNOUNCES LAUNCHING OF "KOSMOS-901"

Moscow PRAVDA in Russian 6 April 1977 p 2

[TASS Report: "'Kosmos-901'"]

[Abstract] The artificial earth satellite "Kosmos-901" was launched in the Soviet Union on 5 April 1977. The satellite was inserted into an orbit with the following parameters:

-- initial period, 95.5 minutes;
-- apogee, 845 kilometers;
-- perigee, 279 kilometers;
-- orbital inclination, 71 degrees.

TASS ANNOUNCES LAUNCHING OF "METEOR" WEATHER SATELLITE

Moscow PRAVDA in Russian 6 Apr 77 p 2

[TASS Report: "'Meteor' Launched"]

[Text] On 5 April 1977 a "Meteor" meteorological earth satellite was launched in the Soviet Union. The basic mission of the satellite is to provide meteorological information necessary for use in the operational weather service.

The satellite was inserted into an orbit with the following parameters:
-- apogee, 909 kilometers;
-- perigee, 869 kilometers;
-- orbital inclination, 81.2 degrees;
-- initial period of revolution, 102.5 minutes.

The satellite carries meteorological apparatus enabling it to obtain pictures of clouds and snow cover on the illuminated and dark sides of the earth and also to obtain data on the thermal energy reflected and radiated by the earth and the atmosphere.

In addition to the meteorological apparatus, the "Meteor" satellite has: a system to maintain constant orientation of the satellite toward the earth, a power supply system with autonomous orientation of the solar cells toward the sun, a radio system for precise measurement of orbital elements, and a radiotelemetry system for transmitting data on the operation of the instruments and scientific equipment to earth.

The apparatus installed on the satellite is functioning normally. The coordination-computation center is processing the incoming information. Meteorological information goes to the USSR Hydrometeorological Center for processing and utilization. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-902"

Moscow PRAVDA in Russian 8 Apr 77 p 3

[TASS Report: "'Kosmos-902'"]

[Abstract] The artificial earth satellite "Kosmos-902" was launched in the Soviet Union on 7 April 1977. The satellite was inserted into an orbit with the following parameters:

-- initial period, 89 minutes;
-- apogee, 307 kilometers;
-- perigee, 179 kilometers;
-- orbital inclination, 81.4 degrees.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-903"

Moscow PRAVDA in Russian 12 Apr 77 p 2

[TASS Report: "'Kosmos-903' in Flight"]

[Abstract] The artificial earth satellite "Kosmos-903" was launched in the Soviet Union on 11 April 1977. The satellite was inserted into an orbit with the following parameters:

-- initial period, 12 hours 6 minutes;
-- apogee, 40,170 kilometers;
-- perigee, 630 kilometers;
-- orbital inclination, 62 degrees 50 minutes. [5]

BOOK ON ALGORITHMS FOR SPACECRAFT RE-ENTRY

Moscow ALGORITMY UPRAVLENIYA KOSMICHESKIM APPARATOM PRI VKHODE V ATMOSFERU in Russian Izd-vo "Nauka," 1975, 400 pages

[Abstract of monograph by D. Ye. Okhotsimskiy, Yu. F. Golubev and Yu. G. Sikharulidze, "Algorithms for Control of Spacecraft During Atmospheric Re-entry"]

[Text] This monograph is devoted to the problem of control of motion of a space vehicle during atmospheric re-entry (descent of a satellite from orbit, return from the moon or from interplanetary flight). The authors investigate multistep adaptive control algorithms; these are effective in a broad range of re-entry velocities, from first cosmic to hyperbolic, with flight ranges in the re-entry segment from hundreds to 10,000-12,000 km. The formulated algorithms ensure completeness of use of the re-entry corridor, a high accuracy in pointing at the stipulated landing site, a small expenditure of fuel on control, minimum requirements on the controlling moment and retain their applicability under the influence of considerable perturbations. The algorithms impose moderate requirements on electronic computers and make it possible to proceed to their practical use. The developed methods go beyond the problem to be solved. They can be useful in a number of problems of control of motion. The monograph is intended for specialists in the field of control of space vehicles and other moving objects, graduate students and students in advanced courses in physics-mathematics and technical specialties. Fifteen tables, 123 illustrations and bibliography of 121 items.

Table of Contents

RADIOTELEMETERING ASSEMBLY COMPLETED IN BULGARIA

Moscow IZVESTIYA in Russian 12 Apr 77 p 4

[TASS Report: "Voices from Space"]

[Text] A radiotelemetering station assembly has been completed at the astronomical observatory imeni Yuriy Gagarin in the Bulgarian city of Stara Zagora in conjunction with the Central Laboratory of Space Studies. It

will receive, register and process scientific information transmitted from the "Interkosmos" artificial satellites.

The station is equipped with apparatus developed at various research institutes in Bulgaria, the GDR, USSR and Czechoslovakia. [5]

DETAILS ON EXPERIMENTS PERFORMED ON "SALYUT-5"

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 13 Feb 77 p 4

[Article by G. Lomanov, "Paradoxes of Weightlessness"]

[Summary] A specialist who worked under the direction of Doctor of Technical Sciences S. D. Grishin discusses processing of the results obtained in experiments during the first "Salyut-5" expedition. Sfera experiment. The purpose of the experiment was to study how liquid metal melts and hardens in the absence of gravity. By logic, an ideal metal sphere could be produced in space, but scientists regarded it as a theoretical possibility that there would be a distortion of form. In actuality, it was not a sphere, but an ellipse which was formed. Moreover, the surface was pocked with pits like on the surface of a meteor. The material used was Wood's alloy, selected because it melts at 60°. The alloy consists of bismuth, lead, tin and cadmium, and possibly each metal took its own "line of behavior." And although there is no convection in space, neither is there really weightlessness. In reality, microgravitation prevails; there was in fact gravity aboard the "Salyut-5," although it was 10,000 times less than on the earth's surface. Crystal experiment. The first expedition returned to earth several samples of crystals cultivated under weightlessness conditions. The rate of growth of the crystals was somewhat lower than expected. In sections under the microscope with a large magnification it was possible to see "bubbles": gas and fluid-gas inclusions. Under weightlessness conditions the bubbles in solution do not float up. Therefore, there are more inclusions in space crystals. In contrast to ordinary crystals they are formed with an equal probability on all facets. Reaction experiment. This involved soldering. The "Salyut-5" experiment involved use of a high-temperature solder melting at 1,220°. The quality of the soldered seams revealed a good bond. The photographs of sections taken under magnification show the microstructure of the seam. The grains are small, unlike in "terrestrial" solders, in which they have a dendritic form. The gaps between the joined surfaces were filled more uniformly.
[368]

REPORT ON "SALYUT-5" SYSTEMS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 11 Feb 77 p 4

[Article by G. Lomanov, "The Sun Controls the 'Salyut-5'"]

[Summary] The "Terekis" made a successful transfer from the ship to the station. The "Salyut-5" is a truly unique space home consisting of two cylinders, large and small. The diameter of the large cylinder is more than four meters and the total volume of the station and the ship docked to it is about a hundred cubic meters. Almost a half-year has elapsed since the first space watch aboard the "Salyut-5" ended, but all this time the orbital station has been in operation. During these months the earth's surface was photographed and infrared radiation of our Galaxy was investigated. In order for the station to carry out its program the station had to be rigorously oriented in space. During its flight it was acted upon by a wide variety of external factors -- from gravitational moments to solar corpuscular radiation. However weak the solar wind blowing on the "Salyut" "sail" might be, it changes the orientation of the station. Therefore, for ensuring a high accuracy of its stabilization specialists proposed an original solution: they put the sun in harness. The on-board energy supply was small, but solar energy was abundant. The solar cells supply current to an electromechanical stabilization system, thereby greatly reducing fuel expenditures. The "Salyut" had to be oriented stably along its three axes. For this purpose the station has a spherical flywheel. When the "Salyut" under the influence of external moments rotates by some angle in any of the three directions, this is immediately detected by sensing elements. Electronic-logical units are triggered, commands are issued and the sphere begins to rotate and returns the station to its proper position. The spherical flywheel seemingly floats in the air; it is suspended in an electromagnetic field.
[324]

REPORT ON "SOYUZ-24" DOCKING PROCEDURES

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 10 Feb 77 p 4

[Article by G. Lomanov, "House-Warming Day"]

[Excerpt] "The jeweler's accuracy of space flights has already become a reality," said one of the docking specialists. "But in order to understand the complexity of the problem, let's examine a simple example from ordinary life. Visualize that an automobile is stopped on the highway and you, in another car, are whirling directly toward it at a speed of 70 km/hour: such is usually the difference in the velocity of stations and ships in orbit. And now you must brake your vehicle in time, roll up to the stopped vehicle at a slow speed and gently touch it bumper-to-bumper. You will

agree that in order to do this you would have to be an expert driver. And indeed our example is a highly simplified analogy."

"When the ballistics specialists 'lead' the ship to within several kilometers of the station, the 'Soyuz-24' and the 'Salyut-5' still by no means 'look one another in the eye': they are still not spatially oriented. In addition, in our example the automobile stops on the highway; here everything occurs on a single plane, and not in three measurements, as in space. The velocity of the 'Salyut-5' has a lateral component relative to the ship: approaching to the station, the cosmonauts see that it is tipping to one side, or downward, but this is unimportant, since in space these concepts lose their original meaning. It is necessary that this motion be extinguished. All the operations -- braking, acceleration, spatial orientation -- are performed by means of a radiotechnical approach system. Through the antennas of the ship and station it forms a 'radio bridge' and the automatic system comes into operation. The system constantly measures the distance between the 'Salyut' and the 'Soyuz,' the velocity of their approach, angular coordinates of the station and its lateral 'slippage'."

The results of the measurements are undergoing logical processing and the system sends commands to the docking and orientation engines -- there are more than ten of them, and also the approach correction engine. And in the last stage the controls are handed over to the cosmonauts.

"And now let's refine the situation in our example," says my companion smiling. "You do not see any automobile on the highway. You see only its lit stop lights. The docking will occur 'at nighttime' in the earth's shadow, in the complete darkness of space, using the signal lights of the 'Salyut'. To be sure, it is possible to turn on the headlights, and in actuality, the 'Soyuz-24' has a searchlight, but it is scarcely necessary to explain the difference between solar illumination and the contrasting light of headlights."

"What dictates the change to manual control? Is there some reason for not entrusting this final segment to automatic systems?"

"Automatic systems for the time being still do not have what is called a 'sixth sense' due to the presence of a singular threshold in the response of any instrument. Therefore it is deemed desirable to delegate to the cosmonauts the final approach operations."

"But cannot man become confused in an unusual situation?"

"All the operations are many times tested in trainers. So that for Viktor and Yuriy this is familiar work, although under unfamiliar conditions. Continuing our analogy, it can be said that even an excellent knowledge of the rules of the road will not help you if you are behind the wheel for the first time. Automatism of movements comes only with experience. Work in trainers is a school of practical travel along 'space roads.'

But the docking segment, when the ship is controlled manually, is practiced with particular care. They 'docked' hundreds of times on the earth in order that they might dock once in space. But we note that Soviet cosmonautics has already repeatedly realized a completely automatic docking of two vehicles."

"A successful docking is dependent on a great number of factors. In actuality, an automatic system can ensure the approach of a ship and a station from a distance up to 25 km. But yesterday the ballistics specialists made a real effort: they brought the ship into the immediate neighborhood of the station! The automatic system ensures approach even at 140 km/hour -- this is the speed of an express train. But yesterday it was not even the speed of an automobile, but that of a pedestrian -- scarcely more than seven kilometers per hour. But the very last stage was completely in the hands of the crew."

"We are observing the station," one hears Gorbatko's voice through the loudspeaker. "Range 180 meters."

"Are the lights on the station normal?" asks the "Zarya."

"We see the lights," answers "Terek." "Range 80 meters, velocity 0.55 meter per second. I am activating manual control."

And after several endless seconds we heard from orbit:

"We are moving."

"Is motion damped?" asks "Zarya."

"Yes, now the work is done," answers "Terek." "We are accelerating. Lateral motion is extinguished."

And now finally the long-expected:

"Docking! The 'docking' light is lit!"

The hooks of the docking unit on the "Salyut-5" and on the "Soyuz-24" are engaged and with a multiton force have drawn the station and the ship together.

And after a minute we heard the question from orbit:

"'Zarya' -- how are you there?"

"We are normal. And you?"

"Yes, we are also well..."

The ship and station in a docked state went into the next revolution. The cosmonauts checked the airtightness and dried their spacesuits. They worked stubbornly and at four o'clock on the first day laid down to sleep.

In commenting on the results of the docking, the flight director Aleksey Stanislavovich Yeliseyev especially noted the excellent work of the ballistics specialists. After orbital corrections the ship and station almost "touched" one another. If, for example, the automatic approach system had not been activated, the "Soyuz-24" would have passed at a distance of several tens of meters from the "Salyut." This is what they call "right on target." The actions of the crew also received a high evaluation. [322]

Abstracts of Scientific Articles

DESCENT ONTO SURFACE OF PLANET WITHOUT ATMOSPHERE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 1, 1977 pp 53-61

[Article by Yu. P. Yablon'ko and G. I. Makarov, "Optimum Control During Descent onto the Surface of a Planet Without an Atmosphere"]

[Abstract] In the final stage of descent of a spacecraft onto the surface of a planet without an atmosphere it is necessary to correct the trajectory of motion in such a way as to ensure landing on a safe part of the surface. The requirement of a minimum of energy expenditures leads to the necessity of optimum control. The choice of an optimality criterion satisfying numerous design restrictions in a general case is difficult. Accordingly, it is necessary to calculate trajectories close to those optimum in energy respects. This paper gives an analytical solution of the variational problem with restrictions on control and phase coordinates. The L. S. Pontryagin maximum principle is used for solving the variational problem. It is assumed that the vehicle has an engine which has adjustable thrust. Motion in a uniform gravitational field is considered. The problem was to determine a program for orientation of the thrust vector ensuring a minimum of energy expenditures during flight for a stipulated distance and satisfying restrictions on the angle of rotation and the maximum maneuvering velocity. Optimum solutions are obtained for a wide range of initial conditions. [345]

ROTATIONAL MOTION OF A COSMONAUT'S BODY

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 1, 1977, pp 62-70

[Article by Ya. M. Shapiro, "Rotational Motion of a Cosmonaut's Body"]

[Abstract] This study is devoted to an investigation of the possibilities of autonomous change in the orientation of a body in a state of weightlessness by means of the motion of his arms and legs. The human body is viewed

as a mechanical system consisting of nine solid bodies: the torso and four extremities, each of which consists of two "links." In weightlessness conditions and in the absence of external contacts only internal forces and the relative motion of the extremities can be used for purposeful orientation of the body relative to the inertial reference system. Application of the law of conservation of kinetic moment to the investigation of this problem makes it possible to obtain the dependence of the required parameters of rotational motion of the body on the characteristics of relative motion of the extremities, without respect to the moments in the joints ensuring this motion. The following aspects of the problem are considered: 1. Case of relative motion of one extremity. 2. Case of simultaneous relative motion of two extremities. 3. Plane motion of system (body, extremity). 4. Symmetrical conical motions of arms about axis passing through the shoulder joints. 5. Plane relative motions of two extremities ("links"). 6. Spatial motion of body in case of spontaneous relative motion of extremity. 7. Orientation of body by means of conical motions of legs. 8. Similarity criterion for dynamic parameters of cosmonauts.
[345]

ION AND NEUTRAL COMPOSITION OF THE UPPER ATMOSPHERE

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977
2A209

[Abstract of article by G. S. Ivanov-Kholodnyy; Moscow, FIZ. IONOSFERY. KRATK. SOOBSHCHENIYA, "Nauka," 1976, pp 72-76, "Ion and Neutral Composition of the Upper Atmosphere and the Problem of the Theory of Formation of the Ionosphere"]

[Text] New data on the neutral composition of the upper atmosphere make it possible to advance the theory of formation of the ionosphere. At the present time there are a number of contradictions between the conclusions of theoretical explanations of the physical state of the ionosphere and experimental results, for the explanation of which it must be surmised that: 1) an inadequacy of the intensity of short-wave solar radiation and the presence of an additional source of ionization; 2) an incorrectness of the values of some reaction constants; 3) incompleteness of the used system of reactions. In analyzing the existing contradictions, the author assumes that the first of them is the least sound because it applies to a comparison of absolute measurements. The other two may be sound. Proceeding on the basis of more precise relative measurements $[NO^+]/[O_2^+]$ and $[O^+]/n_e$ and using up-to-date data on the quantity of N and NO in the upper atmosphere and on the dependence of the reaction constant $O^+ + N_2 \rightarrow NO^+ + N$ on electron temperature, it is possible to decrease the scatter between the experimental and theoretical values by several times. Also discussed is the problem of explaining the seasonal anomaly of the ionospheric F2 region, which is possible only with a simultaneous allowance for the semiannual [O] variations and seasonal electron temperature variations. Bibliography of 12 items.
[390]

OPTIMUM CONTROL OF ROTATION OF DYNAMICALLY SYMMETRIC SATELLITE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 1, 1977 pp 24-33

[Article by L. D. Akulenko and Yu. R. Roshchin, "Asymptotic Solution of Some Problems in Optimum Control of Rotation of a Dynamically Symmetric Satellite"]

[Abstract] The paper discusses the optimum control of rotation of a dynamically symmetric satellite using low-thrust engines. The characteristics of the controlled object are assumed to be constant and the change in the kinetic moment during the period of rotation is small in comparison with its value. Perturbing gravitational moments are taken into account for a satellite close to spherically symmetric. An investigation is also made for small angular velocities comparable to the mean motion of a satellite in an elliptical orbit. The averaging method for standard systems with a rotating phase containing small controlling effects is used for the approximate solution of these problems. Case 1 is approximate optimum control of an axially symmetric free solid body. Case 2 is approximate optimum control of rotation of a satellite close to spherically symmetric.
[345]

DESCENT OF SPACECRAFT OF GLIDING TYPE FROM SATELLITE ORBIT

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 1, 1977 pp 34-41

[Article by O. A. Nogov and L. I. Sindyukova, "Synthesis of Control of Descent of a Spacecraft of the Gliding Type from an Artificial Earth Satellite Orbit with Change in the Banking Angle"]

[Abstract] The authors have synthesized autonomous discrete control of the descent of a spacecraft of the gliding type with the use of two controlling parameters -- the modulus and sign of the banking angle. Methods are proposed for finding a nominal control program and control law with coefficients of this law optimum with respect to the accuracy criterion. The algorithm ensures an adequate effectiveness and can be used for control systems one of the principal requirements for which is associated with restrictions on weight and volume.
[345]

CALIBRATION OF ASTROMETRIC CAMERAS

East Berlin VERMESSUNGSTECHNIK in German Vol 24, No 10, 1976 pp 382-384

[Article by J. Ihde, Technology Department, Dresden Technical University, "Calibration of Astrometric Cameras Using a Method with Moving Star Pairs"]

[Abstract] The principle of the method is that an object-side angle, calculated from the equatorial coordinates of a star pair, is compared with the image-side angles calculated from the measured planar plate coordinates of exposure of this star pair. The object-side angle is the same in the individual exposures except for the differential refraction effect. When using the method, we expose several plates with the tested camera for various star pairs at a star image of approximately 1/3 the image field diameter. Using this method, the automatic cameras for astrogeodesy 420, 500 and 760 (SBG cameras made by Carl Zeiss State Enterprise in Jena) were examined at Ondrejov and Potsdam. The distortion coefficients were accurately determined. The attained accuracy was ±1" for m_0. For practical use the results must be smoothed.
[357]

ACCURACY OF MEASUREMENTS OF DISTANCE AND DIRECTION TO SATELLITES

Budapest GEODEZIA ES KARTOGRAFIA in Hungarian Vol 28, No 6, 1976 pp 397-405

[Article by Jozsef Adam, Space Geodetic Observatory, "Accuracy Analysis of Simultaneous Distance and Direction Measurements to Artificial Satellites"]

[Abstract] Studies were carried out to establish the geometric conditions (relative position of station and artificial satellite) under which the components of the topocentric vector can be determined most reliably. The reliability of the artificial satellite coordinates is insignificantly affected by the geometry, as coordinate measurements indicate. Depending on the accuracy of the observation instruments used and the geometry, deviations of up to two orders of magnitude may develop. Within a given region in space the mean errors of only one coordinate will be minimum. Favorable conditions usually prevail in the neighborhood of 90° declination. In this space region every coordinate can be accurately determined, but only two at the same time. If one knows the approximate coordinates, the expected accuracy can be calculated. Information on this makes it possible to determine the usefulness of observing a particular artificial satellite and the usefulness of the data obtained, particularly if the measuring instruments are not of the greatest accuracy and reliability.
[360]

PROPAGATION OF SHORT RADIO WAVES IN IONOSPHERE

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 2, 1977 2A232

[Abstract of article by N. D. Borisov and A. V. Gurevich; Gor'kiy, IZV. VYSSH. UCHEB. ZAVEDENIY. RADIOFIZIKA, 19, No 9, 1976, pp 1275-1284, "On the Theory of Propagation of Short Radio Waves in a Horizontally Inhomogeneous Ionosphere"]

[Text] A study was made of the role of wave effects during the propagation of short radio waves in a horizontally inhomogeneous ionosphere. The authors have determined a system of normal modes of the ionospheric waveguide taking into account the effect of horizontal inhomogeneity. It is shown that the expansion coefficients for these modes vary on superdistant and around-the-world trajectories. Bibliography of 11 items.
[390]

INTERPRETATION OF OPTICAL MEASUREMENTS MADE BY "VENERA-8"

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 12, 1976 12.51.246

[Abstract of preprint by T. A. Germogenova, N. V. Konovalov, N. L. Lukashevich and Ye. M. Feygel'son; Moscow, UTOCHNENIYE INTERPRETATSII OPTICHESKIKH IZMERENIY NA AMS "VENERA-8" (Refinement of Interpretation of Optical Measurements on the 'Venera-8' Automatic Interplanetary Station), Institute of Applied Mathematics USSR Academy of Sciences, Preprint No 93, 1976, 30 pages]

[Text] For an interpretation of the optical measurements made on the "Venera-8" space probe the authors use asymptotic formulas for solving the transfer equation in stratified plane media. Also examined are very simple models of the Venusian atmosphere consisting of two or three homogeneous layers. It was possible to determine regions of change in the optical parameters of the selected models and the surface albedo taking into account the scatter of experimental data.
[23]

STABILIZATION OF ROTATIONAL MOTION OF SPACECRAFT

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA, No 19. MATEMATIKA-MEKHANIKA-ASTRONOMIYA in Russian No 4, 1976, pp 145-148, "Stabilization of the Rotational Motion of a Spacecraft"]

[Article by V. I. Klokov, Leningrad State University, "Stabilization of the Rotational Motion of a Spacecraft"]

[Abstract] Instruments of two types are used aboard a spacecraft for registering data on the rotational motion of the vehicle: 1) position orientation sensors, giving information on the angular position of the spacecraft on the basis of measurements of the vectors of directions to the stars, sun, a planet, etc., or on the basis of measurements of some vector fields associated with the planets and other space objects; 2) angular velocity sensors making it possible to judge the projections of the instantaneous angular velocity of the spacecraft onto a coordinate system coupled to the spacecraft. The author proposes another approach. It is assumed that the vehicle carries angular velocity sensors and data on the angular position of the vehicle is obtained by integration of kinematic equations for known angular velocities and initial conditions. In this case it is convenient to use kinematic equations written for the Rodrigues-Hamilton parameters. Therefore it is desirable to use the Rodrigues-Hamilton parameters (quaternion components) for forming the controlling moments. It is postulated that the spacecraft can be considered a solid body having a fixed point at the center of mass O. Two coordinate systems are used: a coordinate system related to the body and an inertial coordinate system. The position of the related coordinate system relative to the inertial system can be characterized by the quaternion $\lambda = (\lambda_0, \lambda_1, \lambda_2, \lambda_3)$. It is assumed that the body is acted upon only by a controlling moment M. The problem of stabilizing the spacecraft in an inertial coordinate system involves finding the controlling moment M ensuring the tendency of the related coordinate system to an inertial system.
[230]

RECTIFICATION OF SMALL-SCALE PLANETARY PHOTOGRAPHS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 6, 1976 pp 85-90

[Article by I. A. Preobrazhenskiy, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "Rectification of Small-Scale Planetary Photographs on the OFTD Orthophotorectifier"]

[Abstract] In the photogrammetric processing of space photographs a timely problem is the rectification of the photographic image for the purpose of increasing its measurement properties. The maximum accuracy in this case is ensured by differential rectification in small sectors. For the rectification of small-scale planetary photographs into cartographic projections it is possible to use the OFTD orthophotorectifier, described here in detail. The described theoretical investigations and experimental studies on the rectification of models and real photographs indicate the theoretical feasibility and practical possibility of using this instrument for the indicated purposes. The desirable directions in improving the instrument are indicated.
[41]

COMMENTS ON FUTURE CETI RESEARCH

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.477

[Article by Zbigniew Paprotny; Warsaw, ASTRONAUTYKA, 19, No 5, 1976 pp 24, "Some Comments on Future CETI Research"]

[Text] This is a brief discussion of the prospects for investigations of the existence of planetary systems with reasoning life in the universe. Bibliography of eight items.
[43]

PARADOXES OF SPACE FLIGHTS

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.385

[Article by Ary Szternfeld; Warsaw, ASTRONAUTYKA, 19, No 5, pp 4-9, "Paradoxes of Space Flights"]

[Text] It is shown that during the launching of a space probe from the orbit of an artificial earth satellite a launching from perigee occurs with a lesser loss of fuel, although at perigee the earth's attraction is greater. Moreover, during the landing of an orbital spacecraft on the earth's surface it is more advantageous to fire the braking engines at apogee. Similar conclusions have also been drawn for spacecraft launched beyond the limits of terrestrial and solar attraction. Bibliography of five items.
[43]

PINPOINTING NONSTATIONARY SOURCES OF ELECTROMAGNETIC RADIATION

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.354

[Article by G. A. Mersov; LOKALIZATSIYA NESTATSIONARNYKH ISTOCHNIKOV ELEKTROMAGNITNOGO IZLUCHENIYA S POMOSHCH'YU FAZOMETRII (Pinpointing of Nonstationary Sources of Electromagnetic Radiation Using Phasometry), Space Research Institute USSR Academy of Sciences, Preprint 286, Moscow, 1976, 22 pages]

[Text] A study was made of the possibility of localizing sources of electromagnetic radiation on the basis of measurements of the exact times of propagation of radiation or measurement of its phases at different points

in space at which spacecraft are located. Algorithms are proposed for such pinpointing when using two, three and four spacecraft. A study is also made of the accuracy in localization and some special cases which are of practical importance.
[43]

DETERMINING SATELLITE ORBIT USING TELEMETRIC AND PHOTOGRAMMETRIC DATA

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.351

[Abstract of article by Ye. P. Aleksashin, B. Ts. Bakhshiyan, A. A. Sukhanov and Yu. S. Timofeyev; Moscow, OBRABOTKA KOSMICH. INFORM., "Nauka," 1976, pp 70-85, "Determination of the Orbit of an Artificial Planetary Satellite on the Basis of Telemetric and Photogrammetric Measurements"]

[Text] A study was made of the problem of determining the trajectory of an artificial planetary satellite using some types of telemetric data and photographs of a planetary surface obtained using an artificial satellite. A method has been developed for the processing of this information with allowance for the principal factors exerting an influence on the trajectory. The paper gives the results of computations for the Martian satellite "Mars-5."
[43]

EXPLORATION OF VENUS BY "VENERA" STATIONS

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.73

[Abstract of article by V. S. Avduyevskiy and M. Ya. Marov; Moscow, AERO-MEKHANIKA I GAZ. DINAMIKA, "Nauka," 1976, pp 205-236, "Investigation of Venus Using Automatic Interplanetary Stations of the 'Venera' Series"]

[Text] The article covers some of the problems associated with the creation of the descent modules of the "Venera" spacecraft and the principal results of measurements carried out with them during the period 1967-1972. Emphasis is on ensuring the heat regime of descent modules designed for operation under conditions of prolonged exposure to high temperature and pressure. Solution of this engineering problem for the first time made it possible to carry out a complex of measurements of the parameters of the Venusian atmosphere (temperature, pressure, chemical composition, etc.). Bibliography of 52 items.
[43]

INVESTIGATION OF IR SPECTRUM OF VENUS

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.206

[Abstract of article by V. I. Gnedykh, V. S. Zhegulev, L. V. Zasova, V. I. Moroz, N. A. Parfent'yev and G. V. Tomashova; Moscow, PREDVARITEL'NYYE REZUL'TATY ISSLEDOVANIYA INFRAKRASNOGO SPEKTRA VENERY NA ORBITAL'NYKH APPARATAKH "VENERA-9" I "VENERA-10" (Preliminary Results of Investigation of the IR Spectrum of Venus on the Orbital Vehicles "Venera-9" and "Venera-10"), Space Research Institute USSR Academy of Sciences, Preprint Pr-273, 1976, 33 pages]

[Text] Using the IR spectrometer aboard the space probes "Venera-9" and "Venera-10" it was possible to obtain about 150 spectra in the region 1.6-2.8 μm with a spectral resolution of 0.1 μm for planetary phase angles from 60 to 120°. Investigation of the CO_2 band near 2 μm confirms the model of a scattering cloud medium and does not agree with a model of simple reflection. It was found that the upper boundary of the cloud layer is situated at an altitude of 65-68 km with a variation of this value of not more than 1-2 km. The vertical profile of the cloud cover is characterized by a scale height 3-5 km. The brightness in the continuous spectrum in the region 2.2-2.4 μm can be explained by a model of a semi-infinite atmosphere with $a \simeq 0.98$ and $g \simeq 0.7$.
[43]

SATELLITE EXPERIMENTS FOR STUDYING MAGNETOSPHERIC-IONOSPHERIC RELATIONSHIPS

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.246

[Abstract of article by K. I. Gringauz; Moscow, KOMPLEKS SPUTNIKOVYKH EKSPERIMENTOV DLYA IZUCHENIYA MAGNITOSFERNO-IONOSFERNYKH SVYAZEY (Complex of Satellite Experiments for Studying Magnetospheric-Ionospheric Relationships), Space Research Institute USSR Academy of Sciences, Preprint Pr-290, 1976, 13 pages]

[Text] The author proposes a complex experiment for studying magnetospheric-ionospheric relationships in the course of which plans call for the simultaneous photometric measurement of auroras from aboard an artificial earth satellite and measurement, aboard this same satellite, of electromagnetic fields and charged particles.
[43]

SURVEYS OF WATER SURFACES FROM SPACE

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.282

[Abstract of article by I. N. Andreyev, G. A. Ivanyan and G. A. Petrosyan; Leningrad, PROBL. FIZ. ATMOSF., No 14, Leningrad University, 1976, pp 86-94, "Selection of Intervals for Surveying Water Surfaces from Space in the Short-Wave Spectral Region"]

[Text] The choice of optimum spectral intervals is one of the fundamental problems in a multispectral aerospace survey of water surfaces. The authors recommend spectral intervals for solving different problems in oceanology and hydrology. For this purpose it is possible to use computations of the spectral contrasts between water surfaces and other types of natural features, taking into account the atmospheric transfer function for spectral contrasts. Bibliography of 11 items.
[43]

SOLUTION OF EQUATIONS OF PERTURBED MOTION OF SATELLITE

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.344

[Abstract of article by V. I. Korobov, V. D. Glebov and S. A. Rudakov; Moscow, OBRABOTKA KOSMICH. INFORM., "Nauka," 1976, pp 31-35, "One Method for Solving the Equations of Perturbed Motion of a Satellite"]

[Text] The article describes a method for the approximate integration of first-degree ordinary differential equations, which in contrast to the well-known S. A. Chaplygin method, does not require finding the upper and lower limits, in each iteration giving one solution which falls between these limits.
[43]

EFFECT OF INTERFERING PARAMETERS ON TRAJECTORY MEASUREMENT PROGRAM

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.346

[Abstract of article by V. B. Britkov; Moscow, VLIYANIYE MESHAYUSHCHIKH PARAMETROV NA OPTIMAL'NUYU PROGRAMMU TRAYEKTORNYKH IZMERENIY (Effect of Interfering Parameters on Optimum Program of Trajectory Measurements), Institute of Applied Mathematics USSR Academy of Sciences, Preprint No 108, 1976, 23 pages]

[Text] A study was made of the problem of finding the optimum moments of measurements when interfering parameters are present. Methods are proposed which make it possible to solve the formulated problem. In the example of the problem of determining the orbit of an artificial satellite of Mars, the author has shown the existence of a significant influence of interfering parameters on the optimum program of trajectory measurements. Also examined are the differences in the combination of parameters to be determined and the interfering parameters. The following chapters are included: 1. Formulation of Problem; 2. Variations of Purpose Function; 3. Method for Improving the Measurement Program; 4. Improvement of Measurements by Gradient Method; 5. Optimum Measurement Program for Determining Orbital Elements of an artificial Martian satellite.
[43]

DIFFERENTIAL CORRECTION OF SPACECRAFT TRAJECTORY PARAMETERS

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.348

[Abstract of article by A. A. Shiryayev; Leningrad, PROGRAMMA DIFFERENTSIAL'NOGO ISPRAVLENIYA PARAMETROV PO TRAYEKTORNYM IZMERENIYAM KOSMICHESKOGO ZONDA (Program for Differential Correction of Parameters for Trajectory Measurements), Institute of Theoretical Astronomy USSR Academy of Sciences, Preprint 09, 1976, 32 pages

[Text] The article describes a program, written in ALGOL language, for the differential correction of the parameters of the trajectory of an aircraft and also geocentric and selenocentric gravitational constants on the basis of measurements from ground stations measuring slant range and radial velocity of spacecraft. The program ensures the correction of these parameters for different "earth-moon" trajectories; for this purpose the program provides for a determination of the components of the initial velocity of the spacecraft on the basis of two of its positions and the time of the flight between them. The article gives a control example for a trajectory for impact on the moon. An appendix gives formulas for computing the partial derivatives of the right-hand sides of the equations of motion of the probe using the corrected parameters and the text of the program. Bibliography of five items.
[43]

RECENT CETI INVESTIGATIONS IN THE USSR

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.2

[Abstract of article by N. S. Kardashev; Moscow, POSLEDNIYE ISSLEDOVANIYA CETI V SSSR (Recent CETI Research in the USSR), Space Research Institute USSR Academy of Sciences, Preprint Pr-279, 1976, 22 pages]

[Text] This is a discussion of the strategy for a search for signals from extraterrestrial civilizations. The conclusion is drawn that only a search for supercivilizations is feasible. The article gives a brief description of experiments carried out in the USSR.
[40]

INFRARED SPECTROSCOPY OF THE MOON FROM THE "SALYUT-4"

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.290

[Abstract of article by M. N. Markov, G. M. Grechko, A. A. Gubarev, Yu. S. Ivanov, and V. S. Petrov; Moscow, INFRAKRASNAYA SPEKTROSKOPIYA LUNY S ORBITAL'NOY STANTSII "SALYUT-4" (IR Spectroscopy of the Moon from the "Salyut-4" Orbital Station); Moscow, Physics Institute Ukrainian Academy of Sciences, Preprint No 7, 1976, 16 pages]

[Text] This paper gives the results of registry of 20 emission spectra (λ = 1-8 μm) of the moon from aboard the "Salyut-4" station using the ITS-K IR telescope-spectrometer with an angular resolution of $1.1 \cdot 10^{-5}$ sr, with a spectral resolution of 0.3μm and a registry time for the spectrum of 2.5 sec. The spectra were similar to the spectra of the lunar regolith registered in laboratories. The spectral maximum falls at λ = 4μm. The value of the reflection coefficient at the maximum is closer to the astronomical data than to the laboratory data. The long-wave edge of the band is steeper and is situated at a lesser wavelength than for the laboratory spectra. The differences are probably associated with the structural differences of laboratory and natural ground. Bibliography of six items.
[40]

PREDICTION OF SOLAR WIND VELOCITY

Moscow REFERATIVNYY ZHURNAL 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 2, 1977 2.62.228

[Abstract of article by Dzh. T. Gosling; Moscow, NABLYUDENIYA I PROGNOZ SOLNECH. AKTIVNOSTI, "Mir," 1976, pp 201-213, "Prediction of Solar Wind Velocity"]

[Text] The first method for predicting the velocity of the solar wind involves the use of the statistical frequency of recurrence of measured velocities. According to data for 1962-1970, the velocity was 375±25 km/sec with a probability 24%, 375±50 km/sec with a probability of 45%. The second method involves a prediction of velocity at the next moment

t_0 + L if it is known at the moment t_0. The correlation coefficient for L = 3 hours is equal to 0.94; for L = 24 hours -- 0.64; for L = 72 hours -- 0.14. This method is suitable for short-period forecasts and is based on the known fact of a rather slow change in the parameters of the solar wind, especially at low velocities. The reliability of such a prediction is reduced at high velocities. The third method uses a partial frequency of recurrence with solar rotation. Only 9% of the details of the preceding rotation remain and the maximum correlation coefficient near 28 days is 0.3. Therefore, such a prediction gives a result differing little from the first method. There is doubt as to the possibility of predicting high-velocity fluxes by such a method. The fourth method involves the use of observations of the flux closer to the sun or to the east of the earth-sun line. It was tested on the basis of data from the spacecraft Pioneer 6, 7 and the artificial earth satellites Vela 3-5. With solar rotation taken into account, the author obtained a correlation coefficient of 0.7 for a distance between spacecraft of less than 2 days in azimuth; it decreases rapidly to 0.28 with a distance of about four days. Prediction by this method for two days in advance is best. Bibliography of 11 items.
[43]

NUMERICAL THEORY OF MOTION OF THE EARTH AND VENUS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 233, No 3, 1977 pp 314-317

[Article by E. L. Akim and V. A. Stepan'yants, Institute of Applied Mathematics, "Numerical Theory of Motion of the Earth and Venus According to Data from Radar and Optical Observations and Observations of the Motion of the Artificial Satellites 'Venera-9' and 'Venera-10'"]

[Abstract] This paper gives the results of formulation of a theory of motion of the Earth and Venus on the basis of a combination of radar and optical observations and observations of the motion of artificial satellites of Venus. The theory is developed using a measurement base of nine years (1967-1976) and is intended for computing highly accurate geocentric coordinates of Venus up to 1980. The theory is of a purely gravitational character. In formulating the theory the parameters of motion of Venus and the center of inertia of the earth-moon system used were the elements of their heliocentric orbits; joint determination of the numerical values of these 12 parameters was carried out by statistical processing. The theory was developed in two stages, described here in detail. The results of determination of the distance R and the radial velocity $\dot{R}$ of the center of mass of the earth, together with accuracy estimates, are given in Table 2. The mathematical expectations of the determined orbital elements of the earth-moon barycenter and Venus are given in Table 3. The authors give a comparison of the new orbits of the Earth and Venus and the orbits determined using the Newcomb theory.
[15]

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